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ALTERNATIVES FOR REDUCING INSECTICIDES ON COTTON AND CORN:

ECONOMIC AND ENVIRONMENTAL IMPACT

Supplement 2

PROCEDURES USED IN SETTING UP THE

AGRICULTURAL PRODUCTION MODEL

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The procedures used in setting up the agricultural production model used in a study of alternatives for reducing insecticides on cotton and corn are described. The major analytical tool used is a spatial equilibrium model of U.S. agriculture. This is a linear programming model that minimizes the cost of producing and transporting corn, sorghum, wheat, oats, barley, rye, soybeans, and cotton given resource availability, technology, and commodity demands. The model can be divided into a supply segment, a nutrient transfer segment, a demand segment, and a transport segment.

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INTRODUCTION

This report describes the procedures used in setting up the agricultural production model used in a study of Alternatives for Reducing Insecticides on Cotton and Corn: Economic and Environmental Impact (Pimentel et al., 1977) and is intended as a supplemental report.

The major analytical tool used in this report is a spatial equilibrium model of U.S. agriculture. This is a linear programming model which minimizes the cost of producing and transporting eight agricultural commodities given resource availability, technology, and commodity demands. The eight commodities are corn, sorghum, wheat, oats, barley, rye, soybeans and cotton.

The model can be divided into four main segments, viz. a supply segment, a nutrient transfer segment, a demand segment and a transportation segment. While these segments are interdependent, description of the model is simplified if each segment is dealt with separately. A schematic representation of the model in Matrix form is shown in Figure 1.

SUPPLY SEGMENT

To reflect the interregional nature of the production of agricultural commodities, the U.S. was divided into 133 producing regions. These regions were based mainly on those used by the Oklahoma State University Farm Enterprise Data System (FEDS), and FEDS budgets for 1973 were used whereever these budgets are available, (Garst, 1975). Where these budgets were not available (i.e. in the Delta States, the Southwestern States and the Northwestern states) the 1970 Aggregate Production Analysis System (APAS) budgets (Stricklan and Harwell, 1971; Pawson, 1973; and Rude, 1971) were updated to reflect 1973 prices and yields of the APAS regions were used. Also in parts of the East, South East and Western United States, neither APAS nor Oklahoma budgets were available. In these areas budgets derived by C.R. Taylor and E.R. Swanson at the University of Illinois (Taylor and Swanson, 1975), were used. The boundaries of all producing regions were assumed to follow county lines. The producing regions are shown in Figure 2. Details of the updating procedure are discussed in Appendix A.

In delineating the boundaries of these regions it is assumed that production technology is homogeneous within each region and that the quality and availability of all inputs except land are such that they will not limit production. Since crop activities are defined only where a particular crop is historically important to the agriculture of a region, and since the budgets have been set up to reflect average production practices, this latter

assumption is not unrealistic. It is therefore assumed that production in any region is limited only by the availability of land. There is also a lower limit on cotton acreage in each producing region based on the requirements of the 1973 Cotton Acreage Allotment program. This program requires that a farmer plant 90% of his base allotment to cotton to be eligible for payments and loans. To allow for the fact that some farmers may not plant cotton and to allow for shifts in allotments between regions the lower limit in each region was set at 80% of the 1973 acreage. The values used are shown in Table 16. The land in each region was divided into four classes of decreasing quality corresponding to classes I-IV of the Conservation Needs Inventory (CNI) classification (Soil Conservation Service, 1961). Acreage data on a county and crop basis were used to determine the availability of land by class in each producing region. (See Appendix B). On the assumption that yields given in the budgets represented weighted average yields over all four classes, data on yield differentials by land quality were used to calculate yields for the relevant crops on each land class. Details of these calculations are shown in Appendix C. It was assumed that variable costs* of production for each crop did not vary by land class within a region. This is in line with the assumption of homogeneous technology.

The activities in each producing region, the variable costs of production, and the yields on each land class are shown in Table 1. The total land available for production within each land class in each producing region is shown in Table 2.

For those producing regions for which irrigated crop activities are defined, an additional land constraint was computed. These extra constraints were aggregated from the set of irrigated crop acreages in the Conservation Needs Inventory, and are shown as part of Table 3.

NUTRIENT TRANSFER SEGMENT

This part of the model transfers nutrients in the form of Total Digestible Nutrients (TDN) and Digestible Protein (DP) from the regional commodity inventory rows to the regional nutrient rows, to satisfy the diet requirements of cattle, sheep and swine. These requirements are to be satisfied at minimum cost. To ensure that the resulting diets remain compatible with with the eating capacity of the animals, a bulk requirement is also included. The derivation of values for these requirements are shown in Appendix D. The transfer coefficients are taken from feed tables published by the National Research Council of the National Academy of Sciences (1969). These are shown in Table 4.

DEMAND SEGMENT

The regional nature of demand for agricultural products was described

*Variable costs refer to those costs which vary directly with the level of production and are not incurred when production ceases, and include such items as seed, fertilizer, pesticides, machinery operating costs, irrigation, and labor.

by specifying 21 consuming regions. The consuming region boundaries follow state lines (Figure 3). They are identical to those used by Taylor and Swanson (1975).

For each of these regions demand rows are specified for each individual commodity and for Total Digestible Nutrients (TDN), Digestible Protein (DP), and Bulk Weight (W) necessary to feed the cattle, sheep and swine in the region.

Demand for individual commodities is the sum of:

(a) domestic demand for human consumption
(b) domestic demand for consumption by all livestock except cattle, sheep and hogs, and
(c) export demand.

Demand for human consumption is based on per captita consumption of each commodity. Demand for TDN, DP and W is calculated separately for cattle, sheep and hogs and is based on the numbers of each type of livestock in each consuming region. Export demand is based on total net exports of each commodity for 1973. Demand constraints are then obtained by adjusting these data to take account of production in each consuming region which is exogenous to the model.

In addition to these regional demands, the model also includes a national demand of 6,697,446,000 lbs for cotton lint, and a single demand for peas in the northwest of 215,001,000 lbs.

Demand for all consuming regions is shown in Tables 5 and 6. Details of the calculations involved are shown in Appendix D.

TRANSPORTATION SEGMENT

This part of the model allows each commodity except cotton lint and peas to be transported between consuming regions so as to satisfy the specified demands at minimum costs. Transport activities are defined for each commodity between the consuming regions. However, no activity is defined for outshipments of a commodity which is not produced within a particular region. A large number of activities are involved and their cost coefficients are shown in Tables 7 - 14. The cost coefficients given reflect costs per 1000 lbs of commodity shipped between the regions involved. These data were based on those used by Eyvindson (1970) for 1963 and have been updated to reflect changes in transport charges between 1963 and 1973. Details of the update procedure are shown in Appendix E.

The transport activities described above and in Tables 7 - 14 are for rail transport. In addition, for transportation from those regions in the Mississippi River Basin to the Delta States and their ports, barge transportation activities are defined. These were taken from Taylor and Swanson (1975), and are given in Table 15, which also includes permissible limits on these activities.

In conclusion, the data for the model were either obtained directly

from current sources or derived and updated from previous studies. Acknowledgements are especially due to C.R. Taylor and E.R. Swanson, who provided the basic structure from which the model was derived and supplied much of the data upon which preliminary analyses were based.

VERIFICATION AND VALIDATION

Verification involves the examination of the coefficients in the model to determine if their values represent the true situation. This is possible where more than one set of independent estimates of particular coefficients exist. In the current model only crop yields could be verified in this way. The first step in this process involved estimating "average model yields" for each state in the model. These were calculated by weighting the yields obtained from the budgets (updated where necessary) by the proportions of each crop in each producing region as given in the Conservation Needs Inventory data. These yields were then compared with the weighted average state reported yields for the period 1972-1974 obtained from published data (USDA, 1974). Major discrepancies were corrected by adjusting all yields in the particular state by a given percentage.

Validation of the model results was attempted by examining the crop acreage data generated when the model was run using current insect control practices and 1973 prices, yields and demands. Exogenous acreage was computed as described in Appendix D and this was added to the model results to take account of the endogenous crops which are grown in regions not covered by the model. Total acreages for each crop in each region were then compared with the corresponding actual 1973 values. Table 17 shows the comparison of total exogenous acres plus base solution acres with actual 1973 data. This comparison provides only a rough validation since the situation described by the model is the long run situation implied by 1973 conditions. Due to lags in adjustment this situation is not reflected in the actual 1973 data. Despite this the model results were reasonably close to the 1973 situation. Cotton acreage increased slightly, corn and soybean acreage declined and there was a corresponding increase in wheat, grain, sorghum, and small grains. In general cotton increased in Texas and Oklahoma and declined in all other areas. Corn moved from the North Central towards the South and West and soybeans moved towards Kansas, Nebraska and the Dakotas. Wheat increased in most areas with the largest increase in Kansas and Nebraska. There were substantial decreases in wheat acreage in the Dakotas and in Illinois. Sorghum acreage shifted out of Kansas and Nebraska and increased substantially in the North Central states. This result was also observed in Taylor and Swanson (1975). Small grains acreage increased in several areas with declines being recorded in Illinois, Iowa, Missouri and California.

Figure 1. Linear Programming Matrix[a]

Constraint	Crop production activities[b]																										
	Dryland																					Irrigated							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
	Corn	Sorghum	Barley	Oats	Rye	Durum W	Other SW	SW	Soybeans	Cotton	WW-F	Durum W-F	Other SW-F	Barley-F	Rye-F	S-W DC	S-O DC	S-BA DC	W-P-SW-F	W-P-WW-F	W-P DC	Soybeans	Cotton	SW	WW	Barley	Oats	Corn	Sorghum
1 Cost	C 1	C 1	C 1	C 1	C 1	C 1	C 1	C 1	C 1	C 1	C 2	C 2	C 2	C 2	C 2	C 1	C 1	C 1	C 4	C 4	C 1	C 1 1	C 1 1	C 1 1	C 1 1	C 1 1	C 1 1	C 1 1	C 1 1
2 Cropland																													
3 Irrigated cropland																													
4 Cotton allotment										1													1						
5 Wheat account						Y	Y	Y			Y	Y	Y			Y			Y	Y	Y			Y	Y				
6 Soybean account									Y							Y	Y	Y				Y							
7 Cottonseed account										Y													Y						
8 Sorghum account		Y																											Y
9 Corn account	Y																										Y		
10 Barley account			Y											Y				Y	Y							Y			
11 Oat account				Y													Y										Y		
12 Rye account					Y										Y														
13 Cotton lint demand										Y													Y						
14 Pea demand																			Y	Y	Y								
15 Cattle TDN																													
16 Cattle DP																													
17 Cattle feed bulk																													
18 Sheep TDN																													
19 Sheep DP																													
20 Sheep feed bulk																													
21 Swine TDN																													
22 Swine DP																													
23 Swine feed bulk																													
24 Barge transportation																													

[a]Most of the columns represent more than one activity, and most of the rows represent more than one constraint. For example, column 1 represents 91 crop production activities, and row 2 represents 135 cropland constraints. Therefore, the actual matrix is much larger than is indicated by this table.

[b]BA = barley, DC = double-cropped, F = fallow, O = oats, P = peas, S = soybeans, W = wheat, SW = spring wheat, WW = winter wheat.

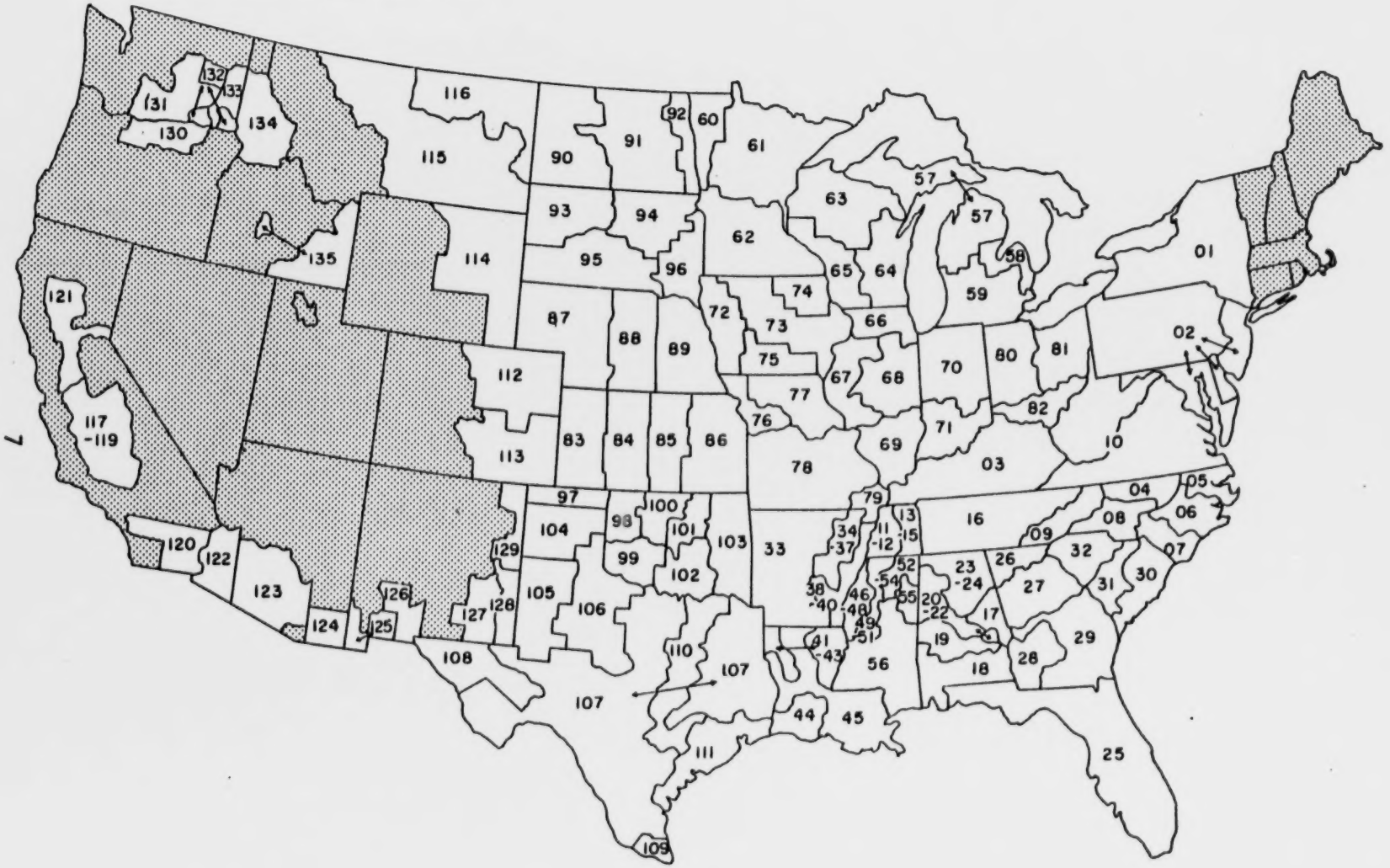
Adapted from Taylor and Swanson (1975).

Figure 1 Continued

Constraint	Activities that transfer commodities to nutrients: Cattle 30 Wheat	31 Barley	32 Oats	33 Rye	34 Sorghum	35 Corn	36 Cottonseed	37 Soybeans	Sheep 38 Wheat	39 Barley	40 Oats	41 Rye	42 Sorghum	43 Corn	44 Cottonseed	45 Soybeans	Swine 46 Wheat	47 Barley	48 Oats	49 Rye	50 Sorghum	51 Corn	52 Cottonseed	53 Soybeans	Rail transportation activities 54 Wheat	55 Soybeans	56 Cottonseed	57 Sorghum	58 Corn	59 Barley	60 Oats	61 Rye	Barge transportation activities 62 Wheat	63 Soybeans	64 Cottonseed	65 Sorghum	66 Corn	67 Barley	68 Oats	69 Rye	Right-hand side
1 Cost																									t	t	t	t	t	t	t	t	tb	tb	tb	tb	tb	tb	tb	tb	MIN
2 Cropland																																										≤L
3 Irrigated cropland																																										≤I
4 Cotton allotment																																										≤CA
5 Wheat account	-1								-1								-1								V								V								$\geq D_1$
6 Soybean account								-1								-1								V		V								V								$\geq D_2$
7 Cottonseed account							-1								-1							-1			V		V							V								$\geq D_3$
8 Sorghum account					-1								-1								-1					V		V							V							$\geq D_4$
9 Corn account						-1								-1								-1					V		V							V						$\geq D_5$
10 Barley account		-1								-1								-1										V		V						V					$\geq D_6$
11 Oat account			-1								-1								-1										V		V						V			$\geq D_7$
12 Rye account				-1								-1								-1										V		V						V	$\geq D_8$
13 Cotton lint demand																																										≤CLD
14 Pce demand																																										≤PD
15 Cattle TDN	tdn	tdn	tdn	tdn	tdn	tdn	tdn	tdn																																	≤TDN$_1$
16 Cattle DP	dp	dp	dp	dp	dp	dp	dp	dp																																	≤DP$_1$
17 Cattle feed bulk	wt	wt	wt	wt	wt	wt	wt	wt																																	≤BW$_1$
18 Sheep TDN									tdn	tdn	tdn	tdn	tdn	tdn	tdn	tdn																									≤TDN$_2$
19 Sheep DP									dp	dp	dp	dp	dp	dp	dp	dp																									≤DP$_2$
20 Sheep feed bu k									wt	wt	wt	wt	wt	wt	wt	wt																									≤BW$_2$
21 Swine TDN																	tdn	tdn	tdn	tdn	tdn	tdn	tdn	tdn																	≤TDN$_3$
22 Swine DP																	dp	dp	dp	dp	dp	dp	dp	dp																	≤DP$_3$
23 Swine feed bulk																	wt	wt	wt	wt	wt	wt	wt	wt																	≤BW$_3$
24 Barge transportation																																	1	1	1	1	1	1	1	1	≤U

[a] V is a matrix of ones, minus ones, and zeroes such that the transportation activities will remove units of the commodity from the region of origin and add those units to the appropriate accounting row in the destination region.

Figure 2. The Producing Regions



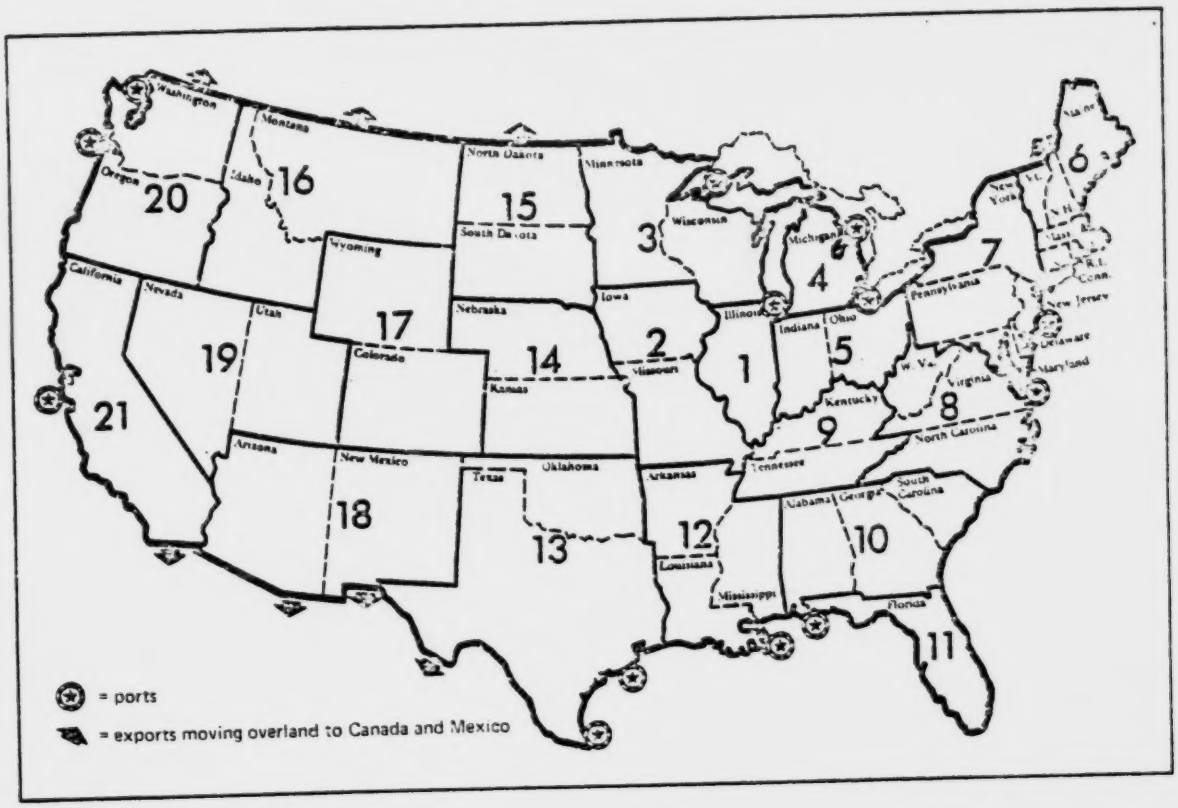


Figure 3. The Consuming Regions.

Source: Taylor and Swanson, (1975)

TABLE 1 -- COST AND YIELD COEFFICIENTS USED IN THE MODEL FOR CROP REDUCING ACTIVITIES

STATE	PRODUCING REGION	CROP ACTIVITY		VARIABLE COST	YIELD* CLASS 1	CLASS 2	CLASS 3	CLASS 4
New York	1	Corn		53.57	97.50	84.75	72.77	60.07
		Winter Wheat		24.97	42.63	42.51	32.15	31.92
		Oats		25.10	57.91	57.78	43.70	43.39
		Barley		28.65	44.24	44.13	33.37	33.14
Pennsylvania	2	Corn		54.89	102.03	79.44	66.91	63.15
New Jersey		Winter Wheat		26.98	41.97	34.31	32.05	30.16
Delaware		Oats		25.24	61.57	50.32	47.03	44.27
Maryland		Barley		29.59	59.88	48.93	45.75	43.05
		Soybeans		37.90	22.44	21.17	18.87	16.52
Kentucky	3	Corn		48.22	107.21	82.11	74.71	52.82
		Winter Wheat		30.94	37.64	32.54	28.88	20.56
		Soybeans		36.68	29.86	25.74	22.02	17.38
North Carolina	4	Corn		51.59	0.00	69.30	60.80	45.01
		Sorghum		44.05	0.00	52.03	45.65	33.80
		Winter Wheat		31.21	36.38	35.70	32.46	30.21
		Oats		38.59	50.68	49.73	45.22	42.08
		Barley		34.64	47.80	46.91	42.65	39.69
		Soybeans		52.97	23.95	21.30	19.72	13.12
	5	Corn		58.59	111.17	101.34	80.36	78.60
		Winter Wheat		52.52	39.48	35.53	35.71	34.21
		Soybeans		52.72	32.18	28.97	26.98	22.44
		Cotton-Solid	Lint	150.44	555.32	472.71	401.00	244.34
			Seed		918.37	781.66	663.08	404.04
	6	Corn		58.80	96.92	88.57	67.07	61.36
		Winter Wheat		53.11	39.72	34.56	32.80	31.00
		Oats		38.62	60.84	52.95	50.24	47.49
		Barley		44.41	48.79	42.46	40.29	38.08
		Soybeans		52.66	25.18	22.29	19.53	16.93
		Cotton-Solid	Lint	145.34	442.46	376.64	319.50	194.68
			Seed		722.05	614.63	521.39	317.70
	7	Corn		58.75	90.75	81.04	63.48	57.50
		Soybeans		52.05	25.35	23.18	19.69	15.14
		Cotton-Solid	Lint	145.34	723.23	615.72	522.32	318.26
			Seed		1179.90	1004.36	852.01	519.16
	8	Corn		60.08	82.01	75.55	66.51	48.58
		Sorghum		46.11	71.51	65.87	57.99	42.36
		Winter Wheat		31.20	33.77	33.68	30.40	27.73
		Oats		38.54	47.90	47.76	43.12	39.33
		Barley		44.06	46.30	46.17	41.68	38.02
		Soybeans		52.98	25.95	23.17	21.16	12.59
		Cotton-Solid	Lint	143.01	384.75	327.51	277.83	169.29
			Seed		628.42	534.93	453.79	276.51

*Yields are given in bushels for all crops except cotton. Yields of cottonseed and cotton lint are given in lbs.

TABLE 1 (Cont.)

STATE	PR	CROP ACTIVITY		COST	YIELD CLASS 1	CLASS 2	CLASS 3	CLASS 4
	9	Corn		67.27	97.90	104.17	86.08	77.48
Virginia	10	Corn		65.36	87.57	73.23	60.55	52.79
West Virginia		Winter Wheat		45.43	30.80	28.82	26.00	25.22
		Barley		48.11	47.16	44.11	39.80	38.62
		Soybeans		52.10	27.72	25.52	21.03	15.43
Tennessee	11	Corn		54.93	79.18	67.81	52.45	42.60
		Winter Wheat		42.44	41.06	34.21	32.24	27.65
		Oats		35.86	48.75	40.61	38.27	32.83
		Soybeans		42.02	29.00	30.97	20.67	21.83
		Cotton-Solid	Lint	157.08	636.37	529.23	408.21	327.86
			Seed		1036.66	862.14	664.98	534.09
	12	Corn		54.73	58.19	49.84	38.54	31.31
		Winter Wheat		42.41	37.82	31.51	29.69	25.47
		Oats		35.82	44.58	37.13	34.99	30.02
		Soybeans		41.94	22.21	23.71	15.83	16.71
		Cotton-Solid	Lint	152.83	555.54	462.01	356.36	286.21
			Seed		905.80	753.30	581.04	466.67
	13	Corn		50.97	65.09	57.20	43.46	35.14
		Soybeans		40.35	22.77	21.67	18.13	17.17
		Cotton-Solid	Lint	141.54	472.93	441.19	363.86	297.52
			Seed		771.57	719.78	593.62	485.38
	14	Corn		51.10	81.36	71.50	54.33	43.93
		Soybeans		40.38	27.00	25.70	21.49	20.36
		Cotton-Solid	Lint	134.65	418.32	390.24	321.84	263.16
			Seed		694.88	648.23	534.61	437.14
	15	Corn		50.89	54.17	47.61	36.17	29.25
		Cotton-Solid	Lint	131.39	363.71	339.29	279.82	228.80
			Seed		593.78	553.92	456.83	373.54
	16	Corn		67.96	104.22	79.05	65.85	45.04
		Winter Wheat		40.12	35.63	32.87	26.91	22.23
		Barley		35.69	33.46	30.87	25.27	20.88
		Soybeans		40.95	23.97	15.87	19.65	14.03
Alabama	17	Corn		47.29	62.32	64.89	49.61	40.84
		Winter Wheat		42.72	22.78	22.28	20.10	18.22
		Oats		32.25	40.75	39.86	35.96	32.60
		Soybeans		42.43	22.96	22.21	20.03	16.76
		Cotton-Solid	Lint	142.15	477.03	541.58	405.36	377.34
			Seed		778.82	884.22	661.82	616.08
	18	Corn		51.17	49.86	42.93	31.88	26.18
		Winter Wheat		44.11	21.21	19.98	17.41	12.89
		Oats		32.69	40.14	37.81	32.95	24.39
		Soybeans		49.96	25.68	24.14	18.80	15.90
		Cotton-Solid	Lint	147.29	489.43	486.53	413.04	354.36
			Seed		798.77	794.04	674.10	578.32

TABLE 1 (Cont.)

STATE	PR	CROP ACTIVITY		VARIABLE COST	YIELD CLASS 1	CLASS 2	CLASS 3	CLASS 4
Alabama (cont.)	18	Soybeans-Wheat		Tot.85.35				
		Double Crop		S. 41.24	22.36	21.02	16.36	13.84
				W. 44.11	21.21	19.48	17.41	12.89
		Soybeans-Oats		Tot.73.93				
		Double Crop		S. 41.24	22.36	21.02	16.36	13.84
				O. 32.69	40.14	37.81	32.95	24.39
	19	Corn		46.54	0.00	49.55	38.62	31.81
		Oats		31.13	42.09	34.04	29.38	23.98
		Soybeans		43.06	21.05	19.48	17.61	13.85
		Cotton-Solid	Lint	122.16	526.75	469.98	381.32	378.64
			Seed		859.81	767.14	622.42	618.04
	20	Corn		51.11	0.00	63.84	38.61	33.98
		Oats		34.97	50.50	46.87	39.38	36.43
		Soybeans		40.91	21.55	20.11	17.32	15.13
		Cotton-Solid	Lint	137.24	613.23	601.48	521.89	419.89
			Seed		1000.47	981.31	851.45	685.04
	21	Corn		63.43	0.00	80.20	48.51	42.69
		Soybeans		48.04	23.72	22.14	19.07	16.66
		Cotton-Solid	Lint	144.47	544.11	533.70	463.43	372.57
			Seed		888.58	871.56	456.81	608.43
	22	Corn		56.61	0.00	53.33	32.26	28.39
		Oats		31.75	35.12	32.53	27.35	25.30
		Cotton-Solid	Lint	136.46	470.62	461.60	400.52	322.24
			Seed		767.90	753.20	653.53	525.80
	23	Corn		52.97	72.70	60.77	52.06	35.69
		Winter Wheat		49.85	31.98	30.02	22.88	22.06
		Oats		32.88	47.51	44.59	33.99	32.78
		Soybeans		50.86	20.49	19.69	17.82	14.31
		Cotton-Solid	Lint	140.71	457.41	415.14	358.66	265.83
			Seed		768.91	697.86	602.91	446.87
		Cotton-2X2skip	Lint	183.01	530.36	481.36	415.86	308.23
			Seed		865.03	785.10	678.28	502.73
	24	Corn		52.97	72.70	60.77	52.06	35.69
		Winter Wheat		49.85	31.98	30.02	22.88	22.06
		Oats		32.88	47.51	44.60	33.99	32.78
		Soybeans		50.86	20.49	19.69	17.82	14.31
		Cotton-Solid	Lint	141.76	376.38	341.87	295.10	218.72
			Seed		613.74	557.03	481.24	356.69
Florida	25	Corn		43.98	0.00	56.68	43.88	43.29
		Winter Wheat		42.70	23.20	20.63	15.84	13.49
		Soybeans		43.72	33.80	30.48	52.97	21.35
		Cotton-Solid	Lint	105.32	325.99	323.86	272.41	237.30
			Seed		532.06	528.60	444.61	387.31
		Soybeans-Wheat		Tot.84.29				
		Double Crop		S. 41.59	22.40	20.20	17.21	14.15
				W. 42.70	19.34	17.19	13.20	11.24

TABLE 1 (Cont.)

STATE	PR	CROP ACTIVITY		VARIABLE COST	YIELD CLASS 1	CLASS 2	CLASS 3	CLASS 4
Georgia	26	Corn		51.86	60.72	52.42	46.94	39.45
		Winter Wheat		47.42	37.65	36.34	28.27	27.42
		Oats		37.05	57.40	55.40	43.10	41.80
		Soybeans		47.60	24.89	24.89	22.18	18.80
		Cotton-Solid	Lint	135.49	354.16	315.86	285.46	235.60
			Seed		577.84	515.34	465.74	384.40
	27	Corn		45.95	54.56	56.63	42.12	35.66
		Winter Wheat		40.28	29.81	29.75	26.77	23.85
		Oats		32.73	51.30	51.20	46.07	41.04
		Barley		37.50	43.09	43.01	38.70	34.47
		Soybeans		40.79	21.14	21.06	18.91	16.53
		Cotton-Solid	Lint	142.18	309.40	415.48	274.72	242.42
			Seed		505.05	678.21	448.44	395.71
		Soybeans-Wheat	Tot.	76.51				
		Double Crop	S.	36.23	15.88	15.82	14.21	12.42
			W.	40.28	29.81	29.75	26.77	23.85
		Soybeans-Oats	Tot.	68.96				
		Double Crop	S.	36.23	15.88	15.82	14.21	12.42
			O.	32.73	51.30	51.20	46.07	41.04
		Soybeans-Barley	Tot.	73.73				
		Double Crop	S.	36.23	15.88	15.82	14.21	12.42
			B.	37.50	43.09	43.01	38.70	34.47
	28	Corn		50.28	55.23	51.38	37.87	39.17
		Winter Wheat		41.80	29.94	27.38	21.01	22.18
		Oats		34.56	54.09	49.46	37.97	40.07
		Soybeans		45.81	24.21	22.06	16.92	17.03
		Cotton-Solid	Lint	154.05	554.63	553.55	470.55	416.11
			Seed		904.49	902.73	767.37	678.59
		Cotton-2X2skip	Lint	193.72	694.57	693.22	589.27	521.10
			Seed		1132.93	1130.73	961.17	849.97
		Soybeans-Wheat	Tot.	82.34				
		Double Crop	S.	40.54	20.15	18.36	14.09	14.18
			W.	41.80	29.94	27.38	21.01	22.18
		Soybeans-Oats	Tot.	75.10				
		Double Crop	S.	40.54	20.15	18.36	14.09	14.18
			O.	34.56	54.09	49.46	37.97	40.07
	29	Corn		54.72	58.48	54.40	40.10	41.47
		Winter Wheat		44.51	30.09	26.96	21.31	21.64
		Oats		33.89	55.62	49.83	39.38	39.99
		Barley		34.57	47.07	42.17	33.33	33.85
		Soybeans		44.37	23.38	21.51	17.53	15.20
		Cotton-Solid	Lint	169.00	484.18	481.87	403.33	308.15
			Seed		790.19	786.42	658.24	502.92
		Soybeans-Wheat	Tot.	84.69				
		Double Crop	S.	40.38	18.73	17.23	14.04	12.18
			W.	44.51	30.09	26.96	21.30	21.64
		Soybeans-Oats	Tot.	74.27				
		Double Crop	S.	40.38	18.73	17.23	14.04	12.18
			O.	33.89	55.62	49.83	39.38	39.99
		Soybeans-Barley	Tot.	74.95				
		Double Crop	S.	40.38	18.73	17.23	14.04	12.18
			B.	34.57	47.07	42.17	33.33	33.85

TABLE 1 (Cont.)

STATE	PR	CROP ACTIVITY		VARIABLE COST	YIELD CLASS 1	CLASS 2	CLASS 3	CLASS 4
South Carolina	30	Corn		56.19	68.41	67.27	47.36	35.01
		Winter Wheat		47.08	28.53	23.76	20.34	0.00
		Oats		34.54	50.72	42.25	36.16	0.00
		Barley		35.00	34.75	28.95	24.77	0.00
		Soybeans		44 82	21.42	20.62	18.06	13.52
		Cotton-Solid	Lint	155.89	628.42	534.93	453.79	276.51
			Seed		1026.00	873.36	740.88	451.44
		Soybeans-Wheat	Tot.	83.49				
		Double Crop	S.	36.41	19.06	18.35	16.07	12.03
			W.	47.08	28.53	23.7	20.34	0.00
		Soybeans-Oats	Tot.	70.95				
		Double Crop	S.	36.41	19.06	18.35	16.07	12.03
			O.	34.54	50.72	42.25	36.16	0.00
		Soybeans-Barley	Tot.	71.41				
		Double Crop	S.	36.41	19.06	18.35	16.07	12.03
			B.	35.00	34.75	28.95	24.78	0.00
	31	Corn		56.12	70.32	60.30	50.56	41.32
		Winter Wheat		47.07	28.02	22.58	17.18	0.00
		Oats		34.62	50.86	40.99	31.19	0.00
		Barley		35.01	41.77	33.66	25.62	0.00
		Soybeans		44.79	20.33	17.22	14.52	11.42
		Cotton-Solid	Lint	156.32	584.15	542.39	468.76	254.58
			Seed		952.53	884.26	764.21	415.04
		Soybeans-Wheat	Tot.	83.46				
		Double Crop	S.	36.38	16.93	14.55	12.27	9.66
			W.	47.07	28.02	22.58	17.18	0.00
		Soybeans-Oats	Tot.	71.00				
		Double Crop	S.	36.38	16.93	14.55	12.27	9.66
			O.	34.62	50.86	40.98	31.19	0.00
		Soybeans-Barley	Tot.	71.39				
		Double Crop	S.	36.38	16.93	14.55	12.27	9.66
			B.	35.01	41.77	33.66	25.62	0.00
	32	Corn		47.33	58.30	60.49	45.34	36.43
		Winter Wheat		43.21	27.14	27.04	24.40	21.70
		Oats		32.34	42.02	41.86	37.77	33.60
		Barley		34.32	42.44	42.28	38.15	33.94
		Soybeans		41.09	18.85	18.89	16.96	15.08
		Cotton-Solid	Lint	142.69	252.93	339.87	226.78	202.16
			Seed		416.00	559.00	373.00	332.50
		Soybeans-Wheat	Tot.	79.61				
		Double Crop	S.	36.40	16.69	16.72	15.02	13.35
			W.	43.21	27.14	27.04	24.40	21.70
		Soybeans-Oats	Tot.	68.74				
		Double Crop	S.	36.40	16.69	16.72	15.02	13.35
			O.	32.34	42.02	41.86	37.77	33.60
		Soybeans-Barley	Tot.	70.72				
		Double Crop	S.	36.40	16.69	16.72	15.02	13.35
			B.	34.32	42.44	42.28	38.15	33.94

TABLE 1 (Cont.)

STATE	PR	CROP ACTIVITY		VARIABLE COST	YIELD CLASS 1	CLASS 2	CLASS 3	CLASS 4
Arkansas	33	Corn		39.44	46.73	34.19	26.42	22.77
		Winter Wheat		30.60	29.06	26.15	21.87	19.81
		Soybeans		47.92	22.55	19.38	15.67	16.94
		Cotton-Solid	Lint	127.97	440.02	418.62	324.08	205.03
			Seed		774.14	736.50	570.17	360.72
	34	Corn		43.45	66.13	48.45	45.84	42.25
		Sorghum		39.21	43.64	31.27	30.54	25.84
		Winter Wheat		40.97	33.54	29.50	28.16	20.38
		Oats		32.64	81.12	71.37	68.12	49.31
		Soybeans		51.03	24.40	25.63	19.46	19.84
		Cotton-Solid	Lint	130.55	702.57	625.34	448.35	341.63
			Seed		1176.50	1047.17	750.80	572.08
	35	Corn		43.55	57.87	51.19	40.11	32.47
		Sorghum		39.21	43.64	31.27	30.54	25.84
		Winter Wheat		40.87	31.30	27.54	26.28	19.03
		Oats		31.87	65.61	57.72	55.10	39.88
		Soybeans		46.00	23.29	24.46	18.57	18.94
		Cotton-Solid	Lint	130.61	547.34	487.55	349.56	265.94
			Seed		916.21	816.12	585.14	445.15
	36	Corn		47.44	79.84	70.76	55.39	47.97
		Winter Wheat		40.78	29.06	25.57	24.41	17.67
		Oats		32.94	64.42	56.67	54.09	39.16
		Soybeans		49.88	26.62	27.95	21.23	21.64
		Cotton-Solid	Lint	135.84	773.42	688.93	493.95	376.37
			Seed		1294.59	1153.16	826.80	629.99
	37	Corn		40.92	57.87	51.14	40.11	33.29
		Winter Wheat		40.97	33.54	29.50	28.16	20.38
		Oats		34.51	81.12	71.37	68.12	49.31
		Soybeans		49.96	27.73	29.12	22.11	22.54
		Cotton-Solid	Lint	125.01	565.19	503.45	360.96	274.61
			Seed		945.95	842.61	604.14	459.61
	38	Corn		53.72	68.66	58.81	45.48	36.95
		Sorghum		34.11	45.94	32.91	32.15	27.20
		Winter Wheat		41.65	36.84	35.71	29.12	0.00
		Oats		30.67	66.34	64.31	52.45	0.00
		Soybeans1		35.30	27.93	26.96	22.93	0.00
		Cotton-4x4skip	Lint	166.98	1039.80	987.39	773.51	0.00
			Seed		1730.77	1643.53	1287.52	0.00
		Cotton-2x2skip	Lint	184.50	1142.67	1085.07	850.03	0.00
			Seed		1902.95	807.08	1415.61	0.00
		Cotton-2x1skip	Lint	171.18	1047.63	994.82	779.33	0.00
			Seed		1744.19	1656.27	1297.51	0.00
		Cotton-Solid	Lint	144.90	793.83	753.81	590.53	0.00
			Seed		1321.56	1254.94	983.11	0.00
	39	Corn		54.58	54.59	46.75	36.16	29.37
		Sorghum		34.11	45.94	32.91	32.15	27.20
		Winter Wheat		40.71	32.23	31.25	25.48	0.00

TABLE 1 (Cont.)

STATE	PR	CROP ACTIVITY		VARIABLE COST	YIELD CLASS 1	CLASS 2	CLASS 3	CLASS 4
Arkansas (cont.)	39	Oats		29.41	51.60	50.02	40.79	0.00
		Soybeans		43.55	25.60	24.71	21.02	0.00
		Cotton-Solid	Lint	152.33	682.02	647.64	507.36	0.00
			Seed		1135.96	1078.70	345.04	0.00
		Cotton-4x4skip	Lint	170.28	872.09	828.13	648.75	0.00
			Seed		1452.37	1379.16	1080.42	0.00
	40	Corn		51.88	54.59	46.75	36.16	29.37
		Sorghum		34.11	45.94	32.91	32.15	27.20
		Winter Wheat		41.65	36.84	35.71	29.12	0.00
		Oats		30.67	66.34	64.31	52.45	0.00
		Soybeans		42.69	25.60	24.71	21.02	0.00
		Cotton-Solid	Lint	144.56	883.27	838.75	657.07	0.00
			Seed		1470.26	1396.15	1093.73	0.00
		Cotton-2x1skip	Lint	174.75	1191.86	1131.78	886.63	0.00
			Seed		1984.57	1884.54	1476.33	0.00
		Cotton-2x2skip	Lint	190.80	1351.75	1283.61	1005.57	0.00
			Seed		2250.67	2137.23	1674.28	0.00
		Cotton-4x4skip	Lint	171.16	1179.56	1120.11	877.48	0.00
			Seed		1964.45	1865.43	1461.36	0.00
Louisiana	41	Corn		54.41	77.13	66.34	53.51	29.78
		Sorghum		28.96	61.73	36.99	26.88	17.76
		Winter Wheat		41.15	32.32	26.97	25.64	0.00
		Oats		30.03	63.51	53.00	50.39	0.00
		Soybeans		34.50	30.14	29.98	23.39	17.64
		Cotton-4x4skip	Lint	162.19	1059.49	927.26	699.88	0.00
			Seed		1763.54	1543.43	1164.96	0.00
		Cotton-2x2skip	Lint	178.71	1164.30	1018.98	769.11	0.00
			Seed		1938.98	1696.98	1280.85	0.00
		Cotton-2x1skip	Lint	165.69	1067.47	934.23	705.14	0.00
			Seed		1777.21	1555.40	1173.99	0.00
		Cotton-solid	Lint	140.54	808.86	707.90	534.31	0.00
			Seed		1346.58	1178.51	889.52	0.00
	42	Corn		52.25	61.95	53.07	42.81	23.92
		Sorghum		28.96	61.73	36.99	26.88	17.76
		Winter Wheat		40.71	28.28	23.60	22.44	0.00
		Oats		28.76	49.40	41.22	39.19	0.00
		Soybeans		41.22	27.63	27.49	21.45	17.69
		Cotton-Solid	Lint	147.81	694.93	608.20	459.06	0.00
			Seed		1157.46	1013.00	764.60	0.00
		Cotton-4x4skip	Lint	165.41	888.60	777.70	586.99	0.00
			Seed		1479.87	1295.17	977.57	0.00
	43	Corn		52.00	47.84	40.89	32.98	18.47
		Sorghum		28.96	62.87	37.67	27.37	18.09
		Winter Wheat		41.95	38.88	32.45	30.85	0.00
		Oats		30.03	65.61	54.76	52.06	0.00
		Soybeans		40.48	25.26	25.12	19.60	16.17
		Cotton-Solid	Lint	140.36	900.00	787.67	594.92	0.00
			Seed		1498.10	1311.12	989.61	0.00
		Cotton-2x1skip	Lint	169.35	1214.43	1062.85	802.22	0.00
			Seed		2022.15	1769.76	1335.79	0.00

TABLE 1 (Cont.)

STATE	PR	CROP ACTIVITY	VARIABLE COST	YIELD CLASS 1	CLASS 2	CLASS 3	CLASS 4
Louisiana(cont)	43	Cotton-2x2skipLint	184.98	1377.34	1205.43	909.84	0.00
		Seed		2293.29	2007.06	1514.89	0.00
		Cotton-4x4skipLint	166.23	1201.90	1051.89	793.95	0.00
		Seed		2001.64	1751.82	1322.24	0.00
	44	Corn	47.27	58.57	52.00	33.94	0.00
		Sorghum	36.99	0.00	19.64	14.50	0.00
		Winter Wheat	43.46	24.84	22.60	22.45	17.82
		Soybeans	43.40	37.70	34.19	29.49	29.91
		Cotton-Solid Lint	118.89	498.35	381.48	301.02	232.36
		Seed		824.77	631.35	498.19	384.55
	45	Corn	43.54	67.56	58.30	44.73	36.47
		Sorghum	32.40	57.01	34.16	24.82	16.40
		Soybeans	45.15	27.56	27.11	21.97	18.93
		Cotton-Solid Lint	110.26	509.21	469.84	367.74	195.12
		Seed		842.90	777.73	608.72	322.98
Mississippi	46	Corn	51.97	56.91	46.95	39.49	21.97
		Sorghum	28.21	33.72	24.16	23.60	19.96
		Winter Wheat	40.13	34.86	33.23	28.15	18.90
		Oats	29.72	62.02	59.11	50.09	33.62
		Soybeans	34.56	23.65	22.92	19.53	20.07
		Cotton-Solid Lint	136.33	859.25	817.02	644.77	400.13
		Seed		1430.46	1360.07	1673.41	666.14
		Cotton-2xlskipLint	161.03	1133.96	1678.24	850.91	528.06
		Seed		1887.92	1795.15	1416.66	879.15
		Cotton-2x2skipLint	173.89	1236.83	1176.05	928.11	575.97
		Seed		2059.77	1958.55	1545.63	959.19
		Cotton-4x4skipLint	157.43	1125.49	1070.18	844.56	524.12
		Seed		1873.40	1781.34	1405.78	872.40
	47	Corn	52.80	45.53	39.16	31.59	17.58
		Sorghum	28.21	33.72	24.16	23.60	19.96
		Winter Wheat	39.69	30.50	29.07	24.64	16.54
		Oats	28.47	48.24	45.98	38.96	26.15
		Soybeans	40.57	21.68	21.01	17.90	18.40
		Cotton-Solid Lint	142.29	738.23	701.95	553.96	343.78
		Seed		1229.57	1169.15	922.66	572.59
		Cotton-4x4SkipLint	159.44	943.96	897.57	708.34	439.58
		Seed		1572.06	1494.80	1179.66	732.07
	48	Corn	50.16	45.53	39.16	31.59	17.58
		Sorghum	28.21	33.72	24.16	23.60	19.96
		Winter Wheat	40.13	34.86	33.23	28.13	18.90
		Oats	29.72	62.02	59.11	50.04	33.62
		Soybeans	39.73	21.68	21.01	17.90	18.40
		Cotton-Solid Lint	136.13	956.06	909.08	717.42	445.22
		Seed		1591.42	1513.21	1194.18	741.09
		Cotton-2xlskipLint	164.66	1290.08	1226.68	968.06	600.76
		Seed		2148.12	2042.56	1611.93	1000.33
		Cotton-2x2skipLint	180.09	1463.14	1391.24	1097.93	681.35
		Seed		2436.15	2316.43	1828.06	1134.46

TABLE 1 (Cont)

STATE	PR	CROP ACTIVITY		VARIABLE COST	YIELD CLASS 1	CLASS 2	CLASS 3	CLASS 4
Mississippi (cont.)	48	Cotton 4x4skip	Lint	161.50	1276.77	1214.03	958.07	594.56
			Seed		2126.33	2021.84	1595.58	990.19
	49	Corn		62.72	82.93	73.68	54.10	44.78
		Sorghum		34.33	36.30	26.01	25.41	21.49
		Soybeans		49.82	23.17	25.44	16.68	18.97
		Cotton-Solid	Lint	158.66	999.88	872.26	579.24	503.72
			Seed		1661.06	1449.04	962.26	836.80
		Cotton-2x1skip	Lint	166.67	1349.84	1177.55	781.97	680.02
			Seed		2242.24	1956.03	1298.94	1129.59
		Cotton-2x2skip	Lint	194.03	1529.82	1334.55	886.23	770.69
			Seed		2540.96	1216.62	1471.99	1280.07
		Cotton-4x4skip	Lint	176.18	1339.85	1168.82	776.18	674.98
			Seed		2225.99	1941.86	1289.53	1121.40
	50	Corn		59.41	59.24	52.63	38.65	31.99
		Sorghum		34.33	36.50	26.15	25.54	21.61
		Winter Wheat		39.91	35.83	22.94	28.60	25.04
		Soybeans		49.82	23.17	25.44	16.68	18.97
		Cotton-Solid	Lint	134.61	839.90	732.69	486.56	423.12
			Seed		1401.09	1222.25	811.66	765.84
		Cotton-2x1skip	Lint	157.45	1112.37	970.38	644.40	560.39
			Seed		1846.04	1610.40	1060.42	929.99
		Cotton-2x2skip	Lint	181.93	1213.61	1058.70	703.05	611.39
			Seed		2016.01	1758.69	1167.89	1015.62
		Cotton-4x5skip	Lint	166.34	1112.37	970.38	644.40	560.39
			Seed		1846.04	1610.40	1069.42	929.99
	51	Corn		56.87	47.39	42.10	30.92	25.59
		Sorghum		34.33	36.50	26.15	25.54	21.61
		Winter Wheat		40.50	38.64	18.35	22.88	20.04
		Soybeans		49.28	18.54	20.35	13.34	15.17
		Cotton-Solid	Lint	133.04	749.91	654.19	434.43	377.79
			Seed		1246.11	1087.05	721.87	627.76
	52	Corn		42.93	71.08	63.15	46.37	38.39
		Sorghum		34.99	35.71	25.58	24.99	21.14
		Oats		31.13	60.31	55.54	49.01	45.14
		Soybeans		32.92	0.00	25.33	22.72	20.37
		Cotton-Hand	Lint	173.67	0.00	720.23	596.34	519.31
			Seed		0.00	1195.80	990.10	862.21
		Cotton-Machine	Lint	113.15	0.00	720.23	596.34	519.31
			Seed		0.00	1195.80	990.10	862.21
	53	Corn		54.29	88.85	78.94	57.97	47.98
		Sorghum		34.99	35.71	25.58	24.99	21.14
		Soybeans		49.02	0.00	30.02	26.93	26.16
		Cotton-Hand	Lint	173.66	0.00	688.46	570.03	496.40
			Seed		0.00	1143.90	947.13	824.79
		Cotton-Machine	Lint	153.95	0.00	688.46	570.03	496.40
			Seed		0.00	1143.90	947.13	824.79

TABLE 1 (Cont.)

STATE	PR	CROP ACTIVITY		VARIABLE COST	YIELD CLASS 1	CLASS 2	CLASS 3	CLASS 4
Mississippi (cont.)	54	Corn		50.05	59.24	52.63	38.64	31.99
		Sorghum		34.99	35.71	25.58	24.99	21.14
		Oats		33.63	41.77	38.37	33.86	31.22
		Cotton-Solid	Lint	148.00	0.00	624.91	517.41	450.58
			Seed		0.00	1037.98	859.44	748.42
	55	Corn		44.63	0.00	51.21	30.97	27.26
		Sorghum		34.28	31.74	22.74	22.21	18.79
		Oats		34.37	0.00	40.42	32.13	30.01
		Soybeans		39.82	28.86	26.38	23.49	19.35
		Cotton-Solid	Lint	105.81	478.04	456.93	360.52	320.69
			Seed		794.09	759.02	598.88	532.70
	56	Corn		45.07	47.01	40.47	30.05	24.68
		Sorghum		28.53	42.04	25.19	18.30	12.10
		Soybeans		45.16	20.23	20.47	15.55	13.87
		Cotton-Solid	Lint	120.69	467.20	430.50	350.00	305.41
			Seed		775.68	714.75	581.10	507.07
Michigan	57	Corn		63.55	0.00	79.79	70.28	38.93
		Winter Wheat		28.60	33.91	31.58	28.87	15.10
		Oats		20.90	48.91	45.54	41.63	21.78
		Rye		15.61	27.37	25.48	23.30	12.19
	58	Corn		61.96	83.92	92.91	54.27	39.20
		Winter Wheat		28.70	41.73	42.82	26.79	19.23
		Oats		23.43	61.52	63.13	39.50	28.35
		Rye		16.09	28.35	29.10	18.20	13.06
		Soybeans		36.82	24.52	23.90	21.16	14.74
	59	Corn		61.04	87.89	83.57	72.68	49.71
		Winter Wheat		30.29	34.63	35.27	27.49	20.48
		Oats		26.92	46.85	47.72	37.19	27.71
		Rye		15.89	27.01	27.52	21.44	15.98
		Soybeans		36.91	25.48	24.83	21.99	15.32
Minnesota	60	Corn		52.80	0.00	66.69	61.75	26.23
		Spring Wheat		29.82	0.00	37.09	34.69	21.45
		Durum Wheat		28.77	0.00	33.74	31.55	19.51
		Oats		16.37	0.00	50.69	47.71	29.32
		Barley		24.98	0.00	47.18	44.12	27.29
		Rye		19.70	0.00	30.56	28.58	17.68
		Soybeans		23.61	23.45	22.88	17.98	14.07
	61	Corn		56.48	91.21	87.03	69.47	49.56
		Spring Wheat		27.03	34.62	34.15	29.31	32.13
		Oats		16.44	53.07	52.36	44.93	35.46
		Barley		21.48	49.51	48.84	41.91	33.08
		Rye		19.11	29.10	28.71	24.63	19.44
		Soybeans		56.48	29.10	27.92	22.55	13.10

TABLE 1 (Cont.)

STATE	PR	CROP ACTIVITY	VARIABLE COST	YIELD CLASS 1	CLASS 2	CLASS 3	CLASS 4
Minnesota (cont.)	62	Corn	61.29	107.12	96.47	82.70	55.64
		Spring Wheat	27.47	39.54	36.00	30.70	22.66
		Oats	17.46	65.95	60.05	51.21	37.80
		Barley	20.18	53.17	48.42	41.29	30.48
		Soybeans	32.73	25.67	25.67	20.18	11.03
		Rye	18.48	38.45	35.01	29.86	22.04
Wisconsin	63	Corn	46.20	81.48	74.76	67.06	49.14
		Winter Wheat	27.05	38.35	35.19	32.17	23.84
		Oats	17.51	38.00	34.87	31.88	23.62
		Soybeans	33.82	35.45	32.82	27.22	17.33
	64	Corn	57.75	95.40	83.03	73.15	58.54
		Winter Wheat	45.11	37.24	33.99	30.60	25.43
		Oats	17.88	40.07	36.57	32.92	27.36
		Soybeans	34.23	34.08	29.97	25.98	21.85
	65	Corn	58.57	98.72	93.96	90.15	64.86
		Winter Wheat	27.31	39.31	37.11	36.15	28.06
		Oats	24.49	51.34	58.57	57.22	36.65
		Soybeans	34.11	25.53	34.53	21.87	11.50
Illinois	66	Corn	68.51	102.88	94.68	78.27	73.65
		Winter Wheat	34.95	40.32	37.72	33.00	31.58
		Oats	16.79	42.49	39.75	34.77	33.28
		Soybeans	35.86	34.56	31.71	22.72	21.89
		Sorghum	33.99	65.24	60.04	49.63	46.70
	67	Corn	64.55	115.45	105.72	90.76	84.56
		Winter Wheat	27.79	37.65	33.38	31.03	29.02
		Oats	16.42	37.54	33.29	30.94	26.93
		Soybeans	34.46	35.42	33.97	28.26	27.24
		Sorghum	33.99	64.58	59.14	50.77	47.30
	68	Corn	65.39	118.70	112.52	90.63	78.83
		Winter Wheat	34.59	39.20	35.86	30.77	25.38
		Oats	15.81	41.71	38.16	32.74	27.01
		Soybeans	34.84	36.68	34.98	27.69	21.79
		Sorghum	33.99	63.21	59.92	48.26	41.98
	69	Corn	61.93	85.53	78.03	75.89	58.22
		Winter Wheat	27.94	27.23	25.13	25.35	16.62
		Oats	15.21	22.32	20.60	20.78	13.62
		Soybeans	34.82	27.02	25.82	24.94	14.80
		Sorghum	33.99	79.71	65.00	55.55	46.82
Indiana	70	Corn	68.96	110.24	106.29	97.23	74.74
		Sorghum	39.43	73.71	71.06	65.01	49.97
		Winter Wheat	34.21	34.30	36.75	30.48	25.56
		Oats	16.69	43.48	46.58	38.64	32.40
		Soybeans	37.18	34.22	33.36	29.38	24.38

TABLE 1 (Cont.)

STATE	PR	CROP ACTIVITY	VARIABLE COST	YIELD CLASS 1	CLASS 2	CLASS 3	CLASS 4
Indiana (cont.)	71	Corn	65.62	109.58	97.09	86.48	60.85
		Sorghum	39.43	81.22	71.97	64.10	45.10
		Winter Wheat	31.44	33.56	32.27	27.00	24.26
		Oats	18.61	38.19	36.72	30.72	22.61
		Soybeans	36.73	27.67	27.27	24.50	18.68
Iowa	72	Corn	58.70	121.31	115.72	94.24	57.60
		Sorghum	39.12	80.99	77.26	62.92	38.45
		Winter Wheat	24.70	41.05	44.31	29.60	22.03
		Oats	18.51	71.90	77.62	51.85	38.59
		Soybeans	34.20	37.04	36.64	28.76	17.98
	73	Corn	63.73	123.21	110.70	104.61	86.79
		Sorghum	39.12	78.24	70.30	66.43	55.12
		Winter Wheat	26.01	32.95	30.25	28.02	24.43
		Oats	18.27	55.83	51.24	47.46	41.38
		Soybeans	34.57	39.14	34.78	33.09	24.11
	74	Corn	64.78	114.70	106.29	106.83	69.80
		Sorghum	39.12	75.78	70.23	70.58	46.12
		Oats	18.62	59.34	54.81	55.74	41.61
		Soybeans	34.45	35.13	3.234	31.82	19.53
	75	Corn	57.79	123.10	113.31	90.59	82.84
		Sorghum	39.12	84.92	78.17	62.50	57.15
		Winter Wheat	27.11	38.34	34.29	29.87	25.21
		Oats	17.53	40.57	36.28	31.61	26.67
		Soybeans	33.85	33.21	32.09	29.30	22.00
Missouri	76	Corn	55.02	111.93	105.56	82.90	55.05
		Sorghum	36.24	84.51	68.92	58.90	49.64
		Winter Wheat	28.74	38.40	40.59	27.09	20.84
		Oats	17.33	37.73	38.88	26.61	20.48
		Soybeans	33.48	35.16	34.54	28.78	17.58
	77	Corn	58.60	111.76	100.30	86.05	70.99
		Sorghum	36.85	97.84	79.79	68.19	57.47
		Winter Wheat	28.32	36.95	31.83	31.67	24.55
		Oats	18.64	38.00	33.59	34.42	25.91
		Soybeans	33.71	31.87	31.11	27.93	19.36
	78	Corn	56.13	104.24	82.21	66.16	64.95
		Sorghum	36.22	83.98	68.48	58.53	49.33
		Winter Wheat	27.59	38.09	32.94	27.37	28.45
		Oats	17.76	39.55	34.20	28.42	29.52
		Soybeans	33.72	32.90	27.46	22.20	22.63
	79	Corn	58.00	98.26	84.16	65.09	52.87
		Sorghum	36.19	82.65	67.39	57.60	48.55
		Winter Wheat	29.28	42.04	39.63	31.45	21.50
		Oats	33.22	64.38	60.68	48.15	33.07
		Cotton-Solid Lint	100.90	457.92	434.88	355.16	213.48
		Seed		801.36	761.04	586.53	373.59
		Soybeans	37.61	26.00	25.35	22.70	18.67

TABLE 1 (Cont.)

STATE	PR	CROP ACTIVITY	VARIABLE COST	YIELD CLASS 1	CLASS 2	CLASS 3	CLASS 4
Ohio	80	Corn	63.83	82.11	81.17	62.79	54.51
		Winter Wheat	31.91	31.12	33.41	23.68	22.39
		Oats	22.64	48.61	52.20	36.99	34.98
		Soybeans	37.61	26.00	25.35	22.70	18.67
	81	Corn	58.12	91.58	84.08	72.85	69.66
		Winter Wheat	31.42	30.24	30.59	26.96	25.43
		Oats	22.42	47.93	48.48	42.73	40.31
		Soybeans	37.07	24.03	24.62	21.36	17.67
	82	Corn	55.44	82.99	76.23	71.92	55.95
		Winter Wheat	30.14	27.35	27.43	23.71	22.19
		Oats	21.04	41.16	41.27	35.68	33.39
		Soybeans	37.84	23.37	24.53	23.15	0.00
Kansas	83	Sorghum	16.83	42.04	38.92	30.91	22.44
		Winter Wheat	15.26	0.00	25.12	20.08	17.28
		Fallow Winter Wheat	22.37	0.00	33.59	36.85	23.10
		Fallow Winter Barley	21.27	0.00	43.83	35.03	30.15
		Oats	11.22	0.00	27.13	21.68	18.66
		Rye	12.78	0.00	13.45	10.75	9.25
		Irrigated Corn	82.03	136.53	114.74	92.59	76.33
		Irrigated Sorghum	58.94	81.34	61.14	58.06	44.56
		Irr. Winter Wheat	39.05	0.00	33.94	38.96	36.20
	84	Sorghum	20.61	46.40	41.17	36.82	29.06
		Winter Wheat	17.65	35.04	30.70	26.00	20.73
		Fallow Winter Wheat	24.23	42.88	37.57	31.82	25.37
		Barley	16.23	40.43	35.42	30.00	23.92
		Oats	13.27	35.21	30.85	26.12	20.83
		Rye	12.05	11.94	10.46	8.86	7.06
		Irrigated Corn	82.03	143.48	96.83	68.44	50.30
		Irrigated Sorghum	58.94	81.80	69.47	64.84	61.37
		Irr. Winter Wheat	39.05	42.74	35.76	20.02	27.99
	85	Corn	35.17	101.75	82.61	82.02	72.58
		Sorghum	25.70	69.75	57.23	50.30	44.87
		Winter Wheat	22.47	37.75	32.91	31.29	25.86
		Fallow Winter Wheat	27.79	47.06	41.03	39.00	32.24
		Barley	20.81	44.39	38.70	36.79	30.41
		Oats	16.95	28.93	25.22	23.98	19.82
		Rye	12.91	11.62	10.13	9.63	7.96
		Soybeans	23.54	28.64	22.68	18.96	13.75
		Irrigated Corn	82.03	140.30	103.07	109.44	91.18
		Irrigated Sorghum	58.94	89.36	72.40	63.99	61.37
		Irr. Winter Wheat	39.05	39.33	35.13	35.38	25.54
	86	Corn	44.17	93.11	72.97	61.79	34.87
		Sorghum	32.17	80.13	64.27	56.13	38.08
		Winter Wheat	25.54	37.30	32.23	28.36	19.63
		Barley	18.75	43.57	37.65	33.13	22.93
		Oats	19.14	38.19	33.00	29.04	20.10
		Rye	19.19	16.78	14.50	12.76	8.83

TABLE 1 (Cont.)

STATE	PR	CROP ACTIVITY	VARIABLE COST	YIELD CLASS 1	CLASS 2	CLASS 3	CLASS 4
Kansas (Cont.)		Soybeans	25.62	28.92	22.90	19.14	13.89
		Irrigated Corn	82.03	120.51	106.96	54.19	0.00
		Irrigated Sorghum	58.94	78.26	72.55	46.95	0.00
		Irr. Winter Wheat	39.05	39.07	0.00	31.26	0.00
Nebraska	87	Corn	27.78	55.30	45.36	35.28	30.97
		Irrigated Corn	56.09	131.19	110.25	88.97	73.35
		Sorghum	19.34	52.25	45.77	37.19	32.24
		Winter Wheat	15.91	30.75	28.66	19.48	17.94
		Fallow Winter Wheat	22.30	35.42	33.02	22.44	20.67
		Fallow Winter Barley	20.50	40.40	37.66	25.60	23.57
		Oats	12.50	26.50	24.70	16.79	15.46
		Rye	10.39	21.82	20.35	13.83	12.73
		Irrigated Sorghum	47.24	88.32	75.88	53.68	48.92
		Irr. Winter Wheat	30.52	52.95	48.07	28.69	29.27
		Irrigated Soybeans	37.00	33.99	32.81	28.87	0.00
	88	Corn	32.23	83.08	53.67	37.14	28.29
		Sorghum	22.44	73.13	51.97	35.23	24.99
		Winter Wheat	16.85	34.42	31.29	38.25	20.25
		Oats	14.33	33.58	30.53	27.56	19.76
		Rye	11.91	16.32	14.84	13.40	9.60
		Irrigated Sorghum	47.24	91.24	63.59	43.62	27.96
		Irr. Winter Wheat	30.52	44.80	43.06	35.23	26.83
		Irrigated Soybeans	37.00	33.99	32.38	28.87	0.00
	89	Corn	43.16	97.41	89.02	73.16	50.86
		Irrigated Corn	58.67	126.45	114.43	99.25	75.90
		Sorghum	34.09	83.59	72.58	62.40	48.44
		Winter Wheat	19.93	25.53	23.15	20.22	15.72
		Fallow Winter Wheat	24.46	41.54	37.67	32.90	25.57
		Oats	15.56	54.09	49.05	42.84	33.30
		Rye	13.86	22.35	20.27	17.71	13.76
		Soybeans	25.55	29.73	29.00	22.79	17.84
		Irrigated Sorghum	47.24	89.40	69.89	60.67	52.76
		Irr. Winter Wheat	30.52	48.44	50.90	39.99	28.07
		Irrigated Soybeans	37.00	33.99	32.38	28.87	0.00
North Dakota	90	Corn	22.20	0.00	36.43	36.58	29.16
		Spring Wheat	17.47	47.84	22.47	15.22	12.22
		Fallow Spring Wheat	23.50	67.55	31.72	21.49	17.25
		Durum Wheat	18.35	59.87	28.11	19.04	15.29
		Fallow Durum Wheat	24.15	78.20	55.79	24.24	19.46
		Oats	13.43	96.67	44.93	30.44	24.44
		Barley	14.52	73.80	34.66	23.48	18.85
		Fallow Winter Barley	21.23	95.91	45.05	39.51	24.50
	91	Corn	2503	0.00	45.84	46.02	36.69
		Spring Wheat	17.92	0.00	20.13	13.28	10.02
		Fallow Spring Wheat	34.98	0.00	28.60	18.87	14.24
		Durum Wheat	18.54	0.00	21.00	13.80	10.46
		Fallow Durum Wheat	25.33	0.00	31.02	20.47	15.45
		Oats	13.94	0.00	31.90	21.05	25.84

TABLE 1 (Cont.)

STATE	PR	CROP ACTIVITY	VARIABLE COST	YIELD CLASS 1	YIELD CLASS 2	YIELD CLASS 3	YIELD CLASS 4
North Dakota (Cont.)	91	Barley	16.10	0.00	32.34	21.34	16.10
		Fallow Winter Barley	22.13	0.00	38.39	25.33	19.12
		Rye	13.19	0.00	27.93	18.44	13.91
	92	Oats	17.75	0.00	50.26	36.99	26.65
		Barley	19.68	0.00	44.20	32.53	23.43
		Fallow Winter Barley	26.43	0.00	42.32	31.14	22.44
		Rye	13.69	0.00	29.36	21.61	15.57
		Soybeans	23.07	26.86	26.20	20.59	16.12
South Dakota	93	Corn	21.88	0.00	102.87	63.56	50.47
		Sorghum	19.00	25.45	24.88	18.67	14.86
		Fallow Winter Wheat	20.79	0.00	36.72	33.06	24.73
		Spring Wheat	16.22	0.00	20.23	18.21	13.62
		Fallow Spring Wheat	21.98	0.00	28.90	26.02	19.46
		Oats	13.75	0.00	36.00	32.41	24.25
		Barley	14.20	0.00	33.23	29.92	22.38
		Fallow Winter Barley	20.48	0.00	45.27	40.76	30.49
		Rye	12.38	0.00	27.57	24.82	18.57
	94	Corn	25.67	48.73	44.33	31.01	23.46
		Sorghum	21.42	33.32	32.58	24.44	19.46
		Winter Wheat	17.05	27.52	25.64	17.49	11.32
		Fallow Winter Wheat	22.37	31.55	29.39	20.06	12.98
		Spring Wheat	17.57	24.79	23.09	15.76	10.20
		Fallow Spring Wheat	23.48	28.46	26.52	18.10	11.71
		Oats	14.98	39.49	36.80	25.11	16.25
		Barley	16.50	26.45	24.64	16.81	10.88
		Fallow Winter Barley	21.69	41.87	39.01	26.62	17.23
		Rye	13.52	36.88	34.36	23.45	15.18
		Soybeans	23.61	29.17	28.18	21.62	33.32
	95	Corn	21.30	0.00	62.03	39.32	34.16
		Sorghum	20.51	0.00	55.49	31.62	25.84
		Winter Wheat	14.02	0.00	27.01	24.16	18.06
		Fallow Winter Wheat	19.32	0.00	30.64	27.40	20.49
		Spring Wheat	15.92	0.00	23.95	21.42	16.01
		Fallow Spring Wheat	21.39	0.00	27.47	24.56	18.37
		Oats	14.76	0.00	41.09	36.74	27.48
		Barley	15.20	0.00	37.57	33.60	25.12
		Rye	12.31	0.00	28.15	25.17	18.82
	96	Corn	28.46	65.52	58.58	43.98	30.43
		Sorghum	25.31	44.61	43.15	31.47	27.21
		Spring Wheat	18.63	28.78	25.91	18.30	13.38
		Fallow Spring Wheat	23.36	33.69	30.33	21.42	15.66
		Oats	17.23	56.53	50.89	35.94	26.28
		Barley	42.95	49.11	44.20	31.22	22.83
		Rye	14.24	36.54	32.90	23.23	16.99
		Soybeans	24.42	25.53	23.52	20.53	.0.00
Oklahoma	97	Irrigated Corn	66.66	0.00	98.00	0.00	0.00
		Sorghum	14.59	0.00	0.00	29.98	26.24
		Irrigated Sorghum	49.58	0.00	0.00	81.16	71.06

TABLE 1 (Cont.)

STATE	PR	CROP ACTIVITY	VARIABLE COST	YIELD CLASS 1	CLASS 2	CLASS 3	CLASS 4
Oklahoma (cont)	98	Irr. Winter Wheat	44.67	0.00	0.00	34.50	32.34
		Winter Wheat	13.60	0.00	0.00	21.80	20.45
		Fallow Winter Wheat	15.71	0.00	0.00	24.74	23.20
		Barley	15.36	0.00	0.00	15.82	14.84
		Sorghum	22.16	30.99	27.97	27.46	13.94
		Winter Wheat	20.07	34.03	25.23	23.63	18.71
		Fallow Winter Wheat	23.78	39.47	29.26	27.41	21.69
		Barley	26.29	42.18	31.27	29.29	23.19
		Cotton-Solid Lint	50.09	504.71	393.05	353.38	0.00
		Seed		807.04	628.49	565.06	0.00
	99	Irrigated Sorghum	45.16	66.98	61.18	60.28	30.14
		Sorghum	22.94	41.96	38.32	37.24	18.86
		Irr. Winter Wheat	36.34	36.76	27.34	25.72	20.22
		Winter Wheat	27.67	35.20	25.95	24.20	19.47
		Fallow Winter Wheat	31.63	40.27	29.69	27.68	22.28
		Barley	30.85	33.51	24.70	23.04	18.54
		Irr.Cotton-Solid Lint	93.50	805.80	605.15	563.74	0.00
		Seed		1289.03	968.05	901.81	0.00
		Cotton-Solid Lint	48.12	451.70	345.22	313.55	215.41
		Seed		721.69	551.55	500.96	344.16
	100	Sorghum	24.68	38.69	35.67	24.98	20.93
		Winter Wheat	27.21	36.42	32.32	27.12	18.60
		Fallow Winter Wheat	31.91	38.73	34.38	28.84	19.78
		Barley	27.18	39.95	35.46	29.75	20.40
	101	Sorghum	21.19	35.14	31.30	21.09	18.12
		Winter Wheat	28.66	34.33	31.36	23.49	17.81
		Oats	25.21	27.22	24.86	18.63	14.12
		Barley	28.61	33.59	30.69	22.99	17.43
	102	Sorghum	28.00	42.02	34.67	26.67	22.17
		Winter Wheat	25.35	18.08	15.44	12.06	9.89
		Soybeans	26.49	23.34	19.56	15.35	14.00
		Cotton-Solid Lint	46.42	355.02	297.33	205.20	167.03
		Seed		567.78	475.52	328.18	267.14
	103	Sorghum	28.04	50.79	36.38	35.54	30.07
		Winter Wheat	27.26	20.03	17.54	13.67	10.90
		Oats	26.61	20.03	17.54	13.67	10.90
		Soybeans	33.25	28.97	24.27	19.05	17.38
Texas	104	Irrigated Corn	66.20	0.00	70.00	0.00	0.00
		Sorghum	14.40	47.82	44.58	26.02	20.19
		Irrigated Sorghum	69.33	104.97	97.94	51.37	46.66
		Winter Wheat	13.57	27.32	24.08	15.32	13.45
		Fallow Winter Wheat	15.61	31.53	27.79	17.68	15.52
		Irr. Winter Wheat	44.97	40.53	35.84	20.35	18.23
		Barley	13.32	44.52	39.25	24.96	21.92
		Cotton-Solid Lint	70.32	0.00	494.47	273.71	261.75
		Seed		0.00	677.43	374.98	385.60
		Irr.Cotton-Solid Lint	92.63	0.00	564.87	320.70	0.00
		Seed		0.00	903.38	512.89	0.00

TABLE 1 (Cont.)

STATE	PR	CROP ACTIVITY		VARIABLE COST	YIELD CLASS 1	CLASS 2	CLASS 3	CLASS 4
Texas (cont.)	105	Irrigated Corn		89.50	0.00	131.10	0.00	0.00
		Sorghum		23.06	0.00	40.65	26.99	22.68
		Irrigated Sorghum		63.53	0.00	108.57	72.45	60.01
		Winter Wheat		10.14	0.00	19.76	11.70	10.01
		Fallow Winter Wheat		12.36	0.00	25.99	15.38	13.16
		Irr. Winter Wheat		49.62	0.00	30.65	17.77	15.74
		Irrigated Soybeans		52.38	0.00	27.80	27.80	27.80
		Soybeans		41.04	34.63	26.55	22.75	21.09
		Cotton-Solid	Lint	70.32	0.00	498.74	362.10	365.94
			Seed		0.00	683.28	496.08	501.34
		Irr.Cotton-Solid	Lint	92.63	0.00	584.81	425.81	424.19
			Seed		0.00	935.27	680.98	678.39
	106	Irrigated Sorghum		41.76	63.31	56.46	57.00	28.50
		Sorghum		20.15	37.18	32.98	31.44	16.85
		Winter Wheat		17.82	23.79	16.62	16.22	13.25
		Oats		20.67	53.91	37.66	36.76	30.02
		Barley		18.66	52.96	37.00	26.11	29.49
		Cotton-Solid	Lint	43.59	526.38	391.64	370.75	315.59
			Seed		868.40	646.10	611.65	520.65
		Irr.Cotton-Solid	Lint	79.34	657.21	491.34	461.70	0.00
			Seed		1155.31	863.72	811.62	0.00
	107	Corn		31.94	53.34	48.45	41.35	21.85
		Sorghum		17.77	57.50	34.46	25.04	16.55
		Irrigated Sorghum		40.63	86.58	53.64	28.12	18.17
		Winter Wheat		24.63	19.61	16.60	13.64	11.58
		Irr. Winter Wheat		54.66	34.27	33.33	29.99	25.04
		Barley		14.11	38.25	32.39	26.61	22.59
		Soybeans		63.82	24.53	18.81	16.12	14.94
		Irr.Cotton-Solid	Lint	76.91	865.04	547.06	226.46	148.53
			Seed		1518.37	960.23	397.49	260.71
		Cotton-Solid	Lint	70.49	419.66	294.76	188.57	128.79
			Seed		778.88	547.06	349.98	239.03
	108	Irrigated Barley		54.58	55.27	45.69	34.82	34.26
		Irr.Cotton-Solid	Lint	197.61	884.43	688.04	590.51	366.06
			Seed		1415.36	1101.07	945.00	585.81
	109	Corn		31.94	0.00	48.17	42.92	0.00
		Irrigated Corn		58.71	0.00	43.68	43.68	0.00
		Sorghum		27.77	75.68	31.28	21.17	16.53
		Irrigated Sorghum		60.60	79.99	35.10	18.40	20.37
		Cotton-Solid	Lint	60.29	397.03	140.86	76.40	69.58
			Seed		655.66	232.62	126.16	114.90
		Irr.Cotton-Solid	Lint	126.78	401.71	144.97	76.12	70.24
			Seed		662.93	239.25	125.62	115.91
	110	Sorghum		35.03	58.77	56.26	34.32	23.30
		Winter Wheat		23.59	18.52	18.42	15.92	12.74
		Oats		19.23	27.88	27.72	23.96	19.18
		Cotton-Solid	Lint	70.53	307.04	291.32	192.14	110.57
			Seed		491.72	466.55	307.71	177.07

TABLE 1 (Cont.)

STATE	PR	CROP ACTIVITY	VARIABLE COST	YIELD CLASS 1	CLASS 2	CLASS 3	CLASS 4
Texas (cont.)	111	Corn	43.54	45.37	42.29	19.72	21.24
		Sorghum	31.50	62.33	59.45	49.62	31.05
		Irrigated Sorghum	54.30	82.08	80.08	68.72	0.00
		Soybeans	28.16	16.64	15.09	13.02	13.21
		Cotton-Solid Lint	63.45	329.60	190.20	138.40	110.80
		Seed		527.36	304.32	221.44	177.28
Colorado	112	Corn	23.71	38.50	34.34	19.13	21.01
		Sorghum	13.48	34.95	32.23	18.61	17.16
		Fallow Winter Wheat	13.78	60.29	47.97	22.40	17.66
		Fallow Spring Wheat	16.73	26.70	21.25	9.92	7.82
		Fallow Winter Barley	16.14	71.18	56.65	26.45	20.85
		Irrigated Corn	70.35	120.15	107.12	82.93	65.56
		Irrigated Sorghum	47.31	73.54	67.00	30.70	35.28
		Irr. Winter Wheat	31.81	46.86	45.14	28.76	26.21
		Irr. Spring Wheat	32.54	41.26	39.85	25.39	23.14
		Irrigated Oats	29.05	56.61	54.54	34.74	31.66
		Irrigated Barley	33.87	75.39	72.63	46.27	42.17
	113	Sorghum	11.26	33.31	31.35	15.91	10.06
		Fallow Winter Wheat	11.62	24.41	20.04	9.74	5.42
		Fallow Winter Barley	14.17	90.91	74.64	36.26	20.20
		Irrigated Corn	70.35	113.12	110.95	78.17	62.45
		Irrigated Sorghum	47.31	67.35	63.43	49.21	23.60
		Irr. Winter Wheat	31.81	48.40	46.65	31.31	24.37
		Irr. Spring Wheat	32.54	42.73	41.18	27.64	21.51
		Irrigated Oats	29.05	58.48	56.36	37.82	29.44
		Irrigated Barley	33.87	77.87	75.05	50.37	39.21
Wyoming	114	Irrigated Corn	56.64	103.72	92.35	71.84	0.00
		Fallow Winter Wheat	11.57	50.37	35.87	18.91	19.81
		Irr. Spring Wheat	26.74	34.60	32.02	28.09	0.00
		Spring Wheat	9.90	18.62	13.26	6.99	7.32
		Fallow Spring Wheat	14.77	31.99	22.78	12.01	12.58
		Irrigated Oats	47.57	59.81	55.36	48.55	0.00
		Oats	9.52	66.11	47.08	24.81	26.01
		Irrigated Barley	30.04	72.62	67.22	58.95	0.00
		Barley	10.60	57.11	40.67	21.44	22.47
		Fallow Winter Barley	12.56	82.72	58.91	31.05	32.54
Montana	115	Fallow Winter Wheat	25.69	0.00	36.11	32.94	22.26
		Fallow Soring Wheat	24.24	0.00	27.49	25.08	16.95
		Fallow Durum Wheat	24.16	0.00	27.27	24.88	16.81
		Oats	17.53	0.00	48.37	44.12	29.82
		Fallow Barley	21.14	0.00	35.51	32.39	21.89
	116	Fallow Winter Wheat	22.50	0.00	27.84	24.15	14.15
		Fallow Soring Wheat	19.16	0.00	25.06	21.73	12.74
		Fallow Durum Wheat	19.86	0.00	25.06	21.73	12.74
		Oats	16.50	0.00	40.03	34.72	20.35
		Fallow Barley	17.86	0.00	36.69	31.82	18.65

TABLE 1 (Cont.)

STATE	PR	CROP ACTIVITY		VARIABLE COST	YIELD CLASS 1	CLASS 2	CLASS 3	CLASS 4
California	117	Irrigated Corn		101.52	107.88	80.10	71.89	48.53
		Irrigated Sorghum		71.70	75.87	56.33	50.56	34.13
		Irr. Winter Wheat		60.60	59.60	51.88	50.93	39.22
		Irrigated Barley		54.34	60.20	52.40	51.45	39.62
		Irr. Cotton-Solid	Lint	204.58	886.16	886.16	886.16	886.16
			Seed		1562.44	1562.44	1562.44	1562.44
		Barley-Sorghum	Tot.	126.04				
		Double Crop	B.	54.34	59.83	52.03	51.08	39.36
			S.	71.70	75.87	56.33	50.56	34.13
		Wheat-Sorghum	Tot.	132.30				
		Double Crop		60.60	59.23	51.51	50.57	38.96
				71.70	75.87	56.33	50.56	34.13
	118	Irr. Winter Wheat		74.95	74.50	64.85	63.67	49.03
		Irrigated Barley		67.33	75.55	65.76	64.56	49.72
		Irr.Cotton-Solid	Lint	255.22	2002.02	2002.02	2002.02	2002.02
			Seed		1131.02	1131.02	1131.02	1121.02
		Irr. Cot-2xlskip	Lint	327.10	2497.57	2497.57	2497.57	2497.57
			Seed		1410.86	1410.86	1410.86	1410.86
	119	Irrigated Sorghum		75.85	80.05	59.44	53.35	36.08
		Irr. Winter Wheat		69.66	65.81	57.28	56.24	43.31
		Irrigated Barley		62.77	66.10	57.54	56.49	43.50
		Irr.Cotton-Solid	Lint	212.08	1049.40	1049.40	1049.40	1049.40
			Seed		1865.60	1865.60	1865.60	1865.60
		Irr.Cot.-2xlSkip	Lint	269.33	1311.75	1311.75	1311.75	1311.75
			Seed		2332.00	2332.00	2332.00	2332.00
		Barley-Sorghum	Tot.	138.62				
		Double Crop	B.	62.77	65.69	57.13	56.08	43.21
			S.	75.85	80.05	59.44	53.35	36.08
		Wheat-Sorghum	Tot.	145.51				
		Double Crop	W.	69.66	65.40	56.88	55.83	43.02
			S.	75.85	80.05	59.44	53.35	36.08
	120	Irrigated Sorghum		78.67	0.00	71.54	67.98	57.23
		Irr. Winter Wheat		81.66	80.11	80.11	72.41	64.35
		Irrigated Barley		73.34	79.57	79.57	71.93	63.92
		Irr.Cotton-Solid	Lint	294.95	0.00	1251.44	1251.44	1126.54
			Seed		0.00	2190.03	2190.03	1971.54
		Irr. Cot.-2xlskip	Lint	381.82	0.00	1564.30	1564.30	1408.18
			Seed		0.00	2743.55	2743.55	2469.73
		Barley-Sorghum	Tot.	152.01				
		Double Crop	B.	73.34	78.41	78.41	71.49	64.65
			S.	78.67	0.00	71.54	67.98	57.23
		Wheat-Sorghum	Tot.	160.22				
		Double Crop	W.	81.66	78.94	78.94	71.97	65.09
			S.	78.67	0.00	71.54	67.98	57.23
	121	Corn		76.62	155.84	119.87	108.46	70.19
		Sorghum		54.55	106.04	81.56	73.80	47.76
		Winter Wheat		41.25	42.99	37.92	38.10	28.63

TABLE 1 (Cont.)

STATE	PR	CROP ACTIVITY		VARIABLE COST	YIELD CLASS 1	CLASS 2	CLASS 3	CLASS 4
California (cont.)	121	Irr. Winter Wheat		53.82	64.05	56.50	56.00	42.88
		Barley		40.45	46.38	40.92	41.12	30.90
		Irrigated Barley		51.34	77.58	68.43	69.03	51.94
Arizona	122	Irrigated Sorghum		78.10	0.00	74.69	70.97	59.75
		Irr. Winter Wheat		80.96	69.96	69.96	63.56	0.00
		Irrigated Barley		74.51	76.91	76.91	63.56	0.00
		Barley-Sorghum	Tot.	152.61				
		Double Crop	B.	74.51	76.91	76.91	69.88	59.75
			S.	78.10	0.00	74.68	70.97	69.96
		Wheat-Sorghum	Tot.	159.06				
		Double Crop	W.	80.96	69.96	69.96	63.56	0.00
			S.	78.10	0.00	74.69	70.97	59.75
	123	Irrigated Sorghum		80.65	79.08	56.13	51.41	0.00
		Irr. Winter Wheat		92.39	69.98	65.27	52.53	62.08
		Irrigated Barley		82.91	81.38	77.00	61.98	73.25
		Irr.Cotton-Solid	Lint	288.26	1302.28	859.28	768.48	676.57
			Seed		2188.82	1444.32	1291.70	1137.22
		Irr.Cot.-4xlskip	Lint	322.52	1468.45	968.98	866.58	762.94
			Seed		2455.88	1627.15	1455.21	1281.17
		Barley-Sorghum	Tot.	163.56				
		Double Crop	B.	82.91	81.39	77.00	61.98	73.25
			S.	80.65	79.09	56.13	51.41	68.98
		Wheat-Sorghum	Tot.	173.04				
		Double Crop	W.	92.39	68.98	65.27	52.53	62.09
			S.	80.65	79.09	56.13	51.41	0.00
	124	Irrigated Sorghum		103.69	117.35	83.29	76.20	0.00
		Irr. Winter Wheat		86.56	0.00	64.80	58.63	0.00
		Irrigated Barley		84.19	0.00	79.19	71.65	0.00
		Irr. Cotton-Solid	Lint	207.81	927.87	844.46	761.05	0.00
			Seed		1576.12	1434.43	1292.74	0.00
		Irr. Cot.-2xlskip	Lint	259.13	1156.67	1052.68	948.70	0.00
			Seed		1957.44	1781.47	1605.50	0.00
New Mexico	125	Irrigated Sorghum		99.84	122.70	99.29	68.32	52.74
		Irr. Winter Wheat		83.38	77.07	61.64	51.32	48.56
		Irrigated Barley		80.80	86.66	69.32	57.71	54.61
		Irr. Cot. Solid	Lint	203.74	1406.56	1083.36	675.07	576.58
			Seed		2389.22	1840.23	1146.70	979.40
		Irr.Cot.-2xlskip	Lint	253.87	1753.38	1350.40	841.53	718.75
			Seed		2967.26	2285.45	1424.12	1216.35
	126	Irrigated Sorghum		66.03	74.72	59.86	42.54	32.16
		Irrigated Barley		66.02	69.40	60.00	51.40	43.73
		Irr.Cot.-Solid	Lint	177.47	1061.70	849.70	668.35	435.07
			Seed		1796.72	1437.95	1131.06	736.27
	127	Irrigated Sorghum		69.70	83.20	67.37	45.18	0.00
		Irrigated Barley		60.52	55.88	46.75	41.34	0.00

TABLE 1 (Cont.)

STATE	PR	CROP ACTIVITY	VARIABLE COST	YIELD CLASS 1	CLASS 2	CLASS 3	CLASS 4
New Mexico (cont.)	127	Irr. Cotton-Solid Lint	169.35	992.74	773.07	608.75	406.97
		Seed		1680.01	1308.28	1030.20	688.72
	128	Irrigated Sorghum	84.06	0.00	100.56	120.65	102.19
		Irr. Winter Wheat	66.42	0.00	50.81	54.20	48.44
	129	Irrigated Sorghum	63.97	0.00	62.34	73.32	62.21
		Irr. Winter Wheat	58.27	0.00	41.58	44.33	36.55
		Irr. Cotton-Solid Lint	126.17	0.00	553.35	601.78	0.00
		Seed		0.00	989.51	1076.12	0.00
Oregon	130	Fallow Spring Wheat	21.38	95.16	65.78	37.00	23.14
		Fallow Winter Wheat	25.80	78.74	54.43	30.62	19.15
		Fallow Spring Barley	20.07	71.71	49.58	27.89	17.44
		Fallow Winter Barley	22.47	87.58	60.54	34.06	21.30
Washington	131	Fallow Spring Wheat	20.03	58.04	53.78	23.38	11.73
		Fallow Winter Wheat	21.10	70.12	64.98	28.24	14.17
		Fallow Spring Barley	17.98	63.16	58.53	25.44	12.76
		Rye	16.82	47.79	44.28	19.25	9.65
	132	Fallow Spring Wheat	23.22	56.53	49.31	30.53	20.17
		Fallow Winter Wheat	26.24	68.45	59.59	36.89	24.38
		Fallow Spring Barley	20.09	56.89	49.53	30.66	20.26
		Fallow Winter Barley	25.53	69.47	60.48	37.45	24.75
	133	Fallow Winter Wheat	41.82	0.00	50.31	57.73	37.34
		Irr. Winter Wheat	94.80	0.00	141.48	72.46	73.43
		Irrigated Barley	91.90	0.00	142.10	72.78	73.75
		Barley	28.37	0.00	37.83	43.41	28.08
		Pea-Wheat Tot.	74.28				
		Double Crop W.	36.55	0.00	41.50	47.61	30.79
		P.	37.73				
		Pea-Wheat-Barley Tot.	102.65				
		Fallow W.	36.55	0.00	41.50	47.61	30.69
		B.	28.37	0.00	37.83	43.41	28.08
		P.	37.73				
		Pea-Wheat-Wheat Tot.	110.83				
		Fallow W.	73.10	0.00	82.99	95.22	61.59
		P.	37.73				
Idaho	134	Fallow Winter Wheat	17.06	0.00	24.13	26.94	15.96
		Irr. Winter Wheat	106.56	0.00	0.00	0.00	65.10
		Fallow Winter Barley	17.14	0.00	32.72	36.53	21.63
		Irrigated Barley	98.76	0.00	0.00	0.00	87.98
	135	Fallow Winter Wheat	41.30	0.00	80.91	45.41	29.06
		Irr. Winter Wheat	96.49	0.00	86.91	57.22	29.36
		Irrigated Barley	93.03	0.00	104.82	69.02	35.41
		Barley	28.37	0.00	73.05	41.09	26.24
		Pea-Wheat Tot.	74.28				

TABLE 1 (Cont.)

STATE	PR	CROP ACTIVITY		VARIABLE COST	YIELD CLASS 1	CLASS 2	CLASS 3	CLASS 4
Idaho (cont.)	135	Double Crop	W.	36.55	0.00	66.73	37.54	23.97
			P.	37.73				
		Pea-Wheat-Barley	Tot.	102.65				
		Fallow	W.	36.55	0.00	66.73	37.54	23.97
			P.	37.73		73.05	41.09	26.24
		Pea-Wheat-Wheat	Tot.	110.83				
		Fallow	W.	73.10	0.00	133.45	75.07	47.94
			P.	37.73				

Table 2. Total Acreage for Crop Groups 1-4, by Producing Region and Soil Class

STATE	PRODUCING REGION	SOIL CLASS 1	2	3	4	TOTAL
New York	1	190,421	817,534	608,248	216,760	1,832,963
Del., Md., N.J., Pa.	2	310,790	2,315,122	1,317,145	521,732	4,154,309
Kentucky	3	328,028	1,135,765	568,319	156,040	1,898,152
North Carolina	4	2,087	338,774	191,079	78,586	610,526
	5	62,123	437,393	311,525	22,565	833,606
	6	183,056	719,351	326,551	72,863	1,301,821
	7	74,429	330,571	123,545	42,542	571,087
	8	1,968	372,414	200,824	87,040	662,246
	9	103	24,593	42,634	17,244	84,624
Va. and West Va.	10	194,650	1,046,313	432,137	192,789	1,865,889
	11	88,380	220,774	138,537	53,436	501,127
	12	164,135	410,009	257,285	99,239	930,668
	13	27,856	74,396	36,323	20,427	159,002
	14	18,975	50,675	24,742	13,915	108,307
	15	11,003	23,073	12,306	5,172	51,554
	16	218,046	359,171	248,728	134,558	764,261
Alabama	17	5,426	24,711	39,628	46,555	116,320
	18	198,218	494,122	358,073	94,426	1,144,839
	19	33,865	167,653	72,307	30,846	304,671
	20	7,801	64,294	38,447	15,422	125,964
	21	5,015	41,197	24,687	9,931	80,830
	22	4,676	49,038	29,049	11,660	94,423
	23	59,505	434,745	193,231	78,714	765,195
	24	24,188	176,711	78,542	31,994	311,435
Florida	25	49,687	334,196	1,071,660	219,145	1,674,688
Georgia	26	18,208	66,589	36,729	14,805	136,331
	27	5,420	175,787	151,325	50,254	382,786
	28	212,771	1,045,852	245,916	43,866	1,548,405
	29	112,164	1,206,332	423,084	88,581	1,830,162
S. Carolina	30	233,525	592,896	268,244	102,498	1,197,163

Table 2. (Cont.)

STATE	PR	SOIL CLASS 1	2	3	4	TOTAL
S. Carolina (cont.)	31	118,871	489,647	102,454	127,811	838,783
	32	13,663	249,267	82,780	38,741	384,451
Arkansas	33	266,708	415,191	317,489	44,585	1,043,973
	34	34,073	189,990	254,296	8,336	486,695
	35	71,829	400,519	536,083	17,572	1,026,003
	36	36,935	212,795	285,154	9,235	544,119
	37	82,496	475,286	636,901	20,627	1,215,310
	38	58,002	138,718	457,202	0	654,002
	39	76,128	182,068	600,182	0	858,378
	40	47,127	112,709	371,541	0	531,377
Louisiana	41	73,415	98,412	229,822	678	402,327
	42	96,358	129,166	301,642	885	528,051
	43	59,650	79,960	186,731	547	326,888
	44	54,475	164,827	667,270	70,630	957,202
	45	273,403	324,737	451,048	18,121	1,067,309
Mississippi	46	113,119	125,439	354,886	120,234	713,678
	47	148,469	164,638	465,788	157,807	936,702
	48	91,909	101,919	288,345	97,690	405,416
	49	26,193	158,949	90,823	32,846	165,756
	50	27,054	163,145	92,828	34,117	317,144
	51	8,253	49,767	23,317	10,408	96,745
	52	386	93,526	60,409	34,310	188,631
	53	238	59,545	38,311	21,825	119,919
	54	196	24,109	15,901	7,962	48,168
	55	2,215	158,380	159,720	72,231	392,546
	56	43,449	500,261	227,343	140,532	911,585
Michigan	57	3,804	178,460	312,558	69,116	563,938
	58	19,358	1,112,303	284,460	50,943	1,467,064
	59	39,185	2,278,166	1,011,349	215,297	3,543,997
Minnesota	60	3,973	1,580,500	995,971	235,352	2,815,796
	61	27,563	827,761	424,432	277,376	1,557,132
	62	1,324,050	7,162,741	1,955,213	341,483	10,783,487
Wisconsin	63	19,670	559,377	210,292	127,442	898,781
	64	189,488	1,814,334	490,734	260,936	2,755,492

Table 2. (Cont.)

STATE	PR	SOIL CLASS 1	2	3	4	TOTAL
Wisconsin (cont.)	65	50,389	634,042	460,821	374,614	1,519,866
Illinois	66	576,364	1,796,963	290,729	86,377	2,750,433
	67	1,519,313	2,372,768	382,815	196,323	4,471,220
	68	1,845,004	5,602,942	441,719	143,756	8,033,421
	69	313,783	1,880,500	1,826,533	379,263	4,400,079
Indiana	70	540,013	6,020,381	909,506	402,199	7,872,099
	71	410,330	1,166,939	548,307	215,395	1,290,725
Iowa	72	670,810	2,007,741	1,683,044	223,778	3,975,373
	73	1,627,293	4,956,149	2,066,941	266,453	8,916,836
	74	416,589	1,576,457	461,203	97,282	2,136,448
	75	181,689	760,885	774,365	214,483	1,931,422
Missouri	76	144,539	589,538	640,336	204,016	1,578,429
	77	161,057	750,816	1,920,632	283,381	3,115,886
	78	226,140	700,292	1,457,642	241,016	2,625,090
	79	132,065	358,864	1,204,630	21,581	1,717.140
Ohio	80	152,075	4,507,455	1,062,370	53,394	5,775,294
	81	83,876	803,138	543,670	127,408	1,558,092
	82	91,740	221,395	173,092	44,855	531,082
Kansas	83	653,185	3,129,893	2,978,670	794,146	7,555,894
	84	246,121	3,339,073	1,342,617	944,587	5,872,398
	85	1,006,255	2,170,333	1,509,361	776,020	5,461,969
	86	496,788	1,455,321	2,079,996	442,280	4,474,385
Nebraska	87	193,789	1,883,606	1,383,528	575,406	4,036,329
	88	546,364	1,440,396	457,097	268,811	2,712,668
	89	1,159,143	2,506,066	2,547,650	732,015	6,854,874
N. Dakota	90	11,964	4,343,975	1,907,306	332,884	6,597,129
	91	0	8,261,581	2,559,075	309,317	11,129,973
	92	0	3,166,009	523,290	51,013	3,740,312
S. Dakota	93	280	195,876	322,099	345,733	863,988
	94	186,650	2,988,034	1,014,958	196,904	4,386,546
	95	4,866	986,923	947,976	420,603	2,360,368
	96	1,439,621	2,017,583	654,852	97,981	4,210,037

Table 2. (Cont.)

STATE	PR	SOIL CLASS 1	2	3	4	TOTAL
Oklahoma	97	0	1,172	996,427	197,225	1,194,824
	98	47,766	428,323	386,803	194,839	1,057,731
	99	114,473	1,015,895	583,447	273,280	1,986,095
	100	441,405	939,523	616,632	294,903	2,286,463
	101	95,828	152,794	119,965	49,984	418,571
	102	104,036	296,875	146,330	45,486	592,727
	103	88,937	451,461	112,363	13,599	666,360
Texas	104	34,186	1,287,114	1,901,939	168,590	3,391,829
	105	169,817	1,913,972	2,651,100	711,876	5,446,765
	106	214,886	2,307,077	1,378,620	447,496	4,348,079
	107	473,304	2,362,355	2,174,684	431,838	5,442,181
	108	24,187	143,101	90,469	8,224	265,981
	109	415,137	291,517	126,630	11,084	844,368
	110	188,839	2,104,147	795,730	212,727	3,301,503
	111	117,793	1,066,179	392,135	25,151	1,600,258
Colorado	112	219,103	1,348,619	2,194,477	1,091,735	4,853,934
	113	1,209	289,063	625,920	1,047,454	1,963,646
Wyoming	114	49,560	87,807	414,684	211,695	763,746
Montana	115	42,111	1,109,654	5,048,866	693,298	6,892,929
	116	9,667	1,048,590	2,215,378	405,033	3,678,668
California	117	519,170	302,963	383,012	79,006	1,284,156
	118	296,097	172,791	218,442	45,059	732,389
	119	185,060	107,994	136,526	28,162	457,742
	120	24,950	96,844	275,152	100,845	497,791
	121	164,793	278,016	805,45	356,749	1,606,003
Arizona	122	49,287	19,720	25,580	0	94,587
	123	317,626	160,653	45,538	2,539	526,361
	124	39,113	22,440	28,836	0	90,389
New Mexico	125	3,288	36,714	7.630	7,815	55,447
	126	20,411	39,183	6,858	6,320	37,502
	127	57,916	27,192	9,082	3,383	97,573
	128	0	84,216	83,845	70,604	238,665
	129	2,356	114,834	357,813	42,848	517,851
Oregon	130	475	385,418	1,054,637	133,244	1,573,774

Table 2. (Cont.)

STATE	PR	SOIL CLASS 1	2	3	4	TOTAL
Washington	131	86,997	282,722	1,483,072	671,186	2,524,977
	132	8,275	91,165	1,099,859	321,760	1,521,059
	133	0	131,395	976,018	279,177	1,386,590
Idaho	134	0	173,541	353,511	228,082	756,034
	135	0	322,139	1,220,051	449,403	1,991,593

TABLE 3. Irrigated Acreage for Crop Groups 1-4, by Producing Region and Soil Class

STATE	PRODUCING REGION	SOIL CLASS 1	2	3	4	TOTAL
New York	1	-	-	-	-	-
Del.,Md.,N.J.,Pa.	2	-	-	-	-	-
Florida	25	904	37619	478589	134898	652010
Arkansas	33	44263	35035	44892	8087	132277
	34	12294	79954	96081	4920	193248
	35	25916	168551	202550	10371	407388
	36	13872	90218	108416	5551	218057
	37	30983	201505	242151	12399	487038
	38	7845	11796	77558	0	97200
	39	10297	15482	101795	0	127575
	40	6374	9584	63016	0	78975
Louisiana	41	152	128	7168	0	7448
	42	200	168	9408	0	9775
	43	124	104	5824	0	6051
	44	6503	50209	542907	62902	662521
	45	0	9631	37058	4563	51472
Mississippi	46	20044	6095	22219	6673	55031
	47	26307	7999	29163	8759	72228
	48	16285	4952	18053	5422	44712
	49	151	711	865	0	1727
	50	153	719	875	0	1747
	51	47	219	267	0	533
	52	0	0	0	0	0
	53	0	0	0	0	0
	54	0	0	0	0	0
	55	0	0	0	0	0
	56	0	3379	0	0	3379
Minnesota	60-62	-	-	-	-	-
Wisconsin	63-65	-	-	-	-	-
Illinois	66-69	-	-	-	-	-
Indiana	70-71	-	-	-	-	-
Iowa	72-75	-	-	-	-	-
Missouri	76	500	450	0	0	950
	77	0	70	2827	519	3416
	78	2853	4361	9640	0	16854

Table 3. (Cont.)

STATE	PR	SOIL CLASS 1	2	3	4	TOTAL
	79	8,562	23,693	60,985	507	93,747
Ohio	80-82	-	-	-	-	-
Kansas	83*	653,185	68,714	97,483	25,494	844,876
	84*	96,229	29,236	18,706	3,835	148,006
	85*	43,992	51,242	17,641	3,775	116,650
	86*	15,223	1,832	696	0	17,751
Nebraska	87*	193,789	228,130	64,399	24,696	511,014
	88*	536,701	324,539	89,664	37,636	988,540
	89*	439,996	467,404	116,789	30,015	1,054,204
Oklahoma	97*	0	0	207,775	11,125	218,900
	99*	18,228	89,002	27,710	4,575	139,523
Texas	104*	33,127	1,188,470	147,913	5,059	1,374,574
	105*	150,201	1,982,553	681,121	56,574	2,870,459
	106*	103,444	68,278	31,241	2,855	205,818
	107*	220,528	163,293	144,297	6,854	539,972
	108*	22,607	133,740	84,361	7,689	248,397
	109*	415,137	102,067	20,795	2,622	540,621
	111*	6,977	106,523	165,009	8,439	286,958
Colorado	112*	218,797	360,916	115,180	87,997	782,890
	113*	1,293	284,897	68,035	28,870	383,095
Wyoming	114*	0	121,718	80,607	8,395	210,720
California	117*	435,842	285,326	335,795	59,575	1,116,538
	118*	160,224	112,848	134,953	30,698	438,722
	119*	148,430	98,907	115,462	20,840	383,639
	120*	8,956	71,798	184,686	73,437	338,877
	121*	61,949	127,833	428,013	115,309	733,104
Arizona	122*	21,266	13,[illegible]	15,093	0	49,441
	123*	315,144	159,231	45,113	2,375	521,863
	124*	38,053	21,797	28,097	0	87,947
New Mexico	125*	3,202	35,357	7,473	7,546	53,578
	126*	19,727	36,236	6,753	6,062	68,778
	127*	43,614	24,271	8,469	3,383	79,737
	128*	0	63,464	6,693	24,532	94,689

Table 3. (Cont.)

STATE	PR	SOIL CLASS 1	2	3	4	TOTAL
New Mexico (cont.)	129*	559	108,215	24,918	7,339	141,031
Washington	133*	0	1,200	9,579	1,718	12,497
Idaho	134*	0	71	208	12,937	13,028
	135*	0	285,718	266,781	70,352	622,851

*These values are included in the model as constraints on total irrigated cropland.

TABLE 4. FEED COMPOSITION DATA USED IN THE MODEL.*

CROP	CATTLE		SHEEP		HOGS	
	% TDN	% DP	% TDN	% DP	% TDN	% DP
Corn	81	6.7	87	6.9	82	7.1
Sorghum	71	6.3	84	8.6	78	7.8
Wheat	78	10.0	78	10.0	80	11.7
Oats	68	8.8	67	9.2	65	9.9
Barley	74	8.7	76	9.2	70	8.2
Rye	76	9.4	76	9.4	75	9.6
Soybeans	60	29.456	59.23	31.114	62.386	31.114
Cottonseed	33.733	15.342	31.885	15.342	30.961	16.127

Source: National Research Council of the National Academy of Sciences, 1969.

*This chart gives the percentage of Total Digestible Nutrients (TDN) and Digestible Protein (DP) provided to each class of animals per unit of each crop material.

TABLE 5. NUTRIENT DEMAND (millions of pounds) for Cattle, Sheep, and Hogs.

Consuming Region	CATTLE			SHEEP			HOGS		
	TON	DP	BULK	TON	DP	BULK	TON	DP	BULK
1	4,024	469	5,091	19	4	23	9,776	129	12,142
2	14,981	1,735	19,560	78	19	99	21,349	2,421	26,515
3	12,237	1,500	15,852	66	15	84	8,072	915	10,025
4	2,416	299	3,140	27	6	34	881	100	1,094
5	4,858	582	6,317	82	19	104	7,725	876	9,595
6	1,251	156	1,614	4	1	5	53	6	65
7	9,190	1,162	11,835	100	23	127	1,487	169	1,847
8	1,908	241	2,472	27	6	34	3,249	368	4,035
9	3,043	400	3,935	7	1	9	2,890	328	3,589
10	2,583	350	3,344	0	0	0	3,417	387	4,244
11	1,768	223	2,287	0	0	0	290	33	360
12	2,717	379	3,510	3	1	4	945	107	1,174
13	12,323	1,437	16,091	103	24	131	1,692	193	2,102
14	13,551	1,592	17,697	57	13	73	7,461	846	9,267
15	3,479	453	4,516	57	13	73	3,668	416	4,556
16	2,271	279	2,953	67	16	85	487	55	604
17	5,678	649	7,427	117	27	149	456	52	566
18	3,120	364	4,076	95	22	121	203	23	252
19	809	103	1,051	83	19	105	52	6	65
20	1,552	187	2,017	18	4	22	221	25	275
21	5,923	692	7,714	83	21	112	151	17	188

Table 6. Demand for Commodities (millions of pounds) for seed, and food for humans and all livestock except Cattle, Sheep, and Hogs.

CONSUMING REGION	CORN	SORGH	WHEAT	OATS	BARLEY	RYE	SOYBNS.	COTTON-SEED
1	9,749	184	2,192	298	395	10	4,717	21
2	4,973	647	1,456	773	312	10	2,212	156
3	8,501	517	8,217	2,304	3,038	1,745	3,334	149
4	872	131	1,562	218	256	41	367	23
5	7,997	465	3,172	637	568	29	5,559	94
6	2,657	294	1,936	331	415	36	527	59
7	18,392	1,867	7,877	1,453	1,515	109	2,287	182
8	10,892	399	3,593	562	453	48	2,925	190
9	2,032	40	1,222	396	187	47	750	-13
10	8,205	890	2,269	1,128	552	93	5,468	384
11	1,906	237	1,250	322	281	23	450	50
12	53,789	1,014	10,772	892	490	48	26,638	615
13	2,684	10,830	41,115	-181	550	12	3,286	353
14	1,907	227	872	241	212	90	470	23
15	1,030	108	1,156	449	312	32	373	21
16	268	47	-511	8	-499	5	100	7
17	737	69	142	87	27	-16	181	22
18	509	-99	325	131	-270	9	96	12
19	368	64	-121	37	-325	6	110	38
20	937	130	26,570	-52	1,252	30	241	30
21	5,438	1,351	2,864	720	233	64	1,309	138

TABLE 7. CORN -- TRANSPORT COST COEFFICIENTS BETWEEN CONSUMING REGIONS ($/1000 lbs.)

TO--->	1	2	3	4	5	6	7	8	9	10
FROM										
1	--	1.89	2.55	1.79	1.79	3.48	3.19	3.53	2.64	3.29
2	3.29	--	2.92	5.00	5.00	7.17	6.75	4.18	3.20	3.75
3	4.44	2.92	--	5.43	5.13	7.25	6.82	4.24	3.55	4.05
4	1.79	2.86	3.11	--	1.81	3.08	2.91	3.24	2.92	3.32
5	1.78	2.86	2.94	1.81	--	2.97	2.72	2.96	2.21	2.76
6	--	--	--	--	--	--	--	--	--	--
7	3.19	3.87	3.91	2.91	2.72	2.22	--	2.04	3.52	3.36
8	2.13	2.61	2.65	1.96	1.79	1.77	1.23	--	3.17	2.95
9	3.14	3.75	4.16	3.48	2.64	4.83	4.19	3.17	--	2.00
10	3.91	4.39	4.74	3.95	3.28	4.66	4.01	2.95	2.00	--
11	4.65	5.04	5.34	4.68	4.16	4.88	4.26	3.06	3.05	2.44
12	4.45	7.50	8.06	4.77	4.17	6.16	5.69	5.30	3.54	3.35
13	5.07	7.24	8.74	5.55	5.02	6.75	6.20	5.87	4.39	4.67
14	5.00	2.62	3.62	4.77	5.58	7.75	7.30	4.44	3.48	3.81
15	5.46	3.79	3.02	6.22	5.99	7.78	7.42	4.63	4.04	4.46
16	--	--	--	--	--	--	--	--	--	--
17	6.40	4.10	4.50	7.01	6.70	8.36	8.03	5.00	4.21	4.62
18	--	--	--	--	--	--	--	--	--	--
19	--	--	--	--	--	--	--	--	--	--
20	--	--	--	--	--	--	--	--	--	--
21	17.33	15.58	16.72	18.98	18.42	21.39	21.39	20.60	17.05	17.63

NOTE: -- indicates that no transportation for this crop is defined between these two regions.

Figure 3 contains a map of the Consuming Regions.

TABLE 7. (continued) CORN -- TRANSPORT COST COEFFICIENTS BETWEEN CONSUMING REGIONS ($/1000 lbs.)

TO---->	11	12	13	14	15	16	17	18	19	20	21
FROM											
1	3.90	2.08	2.36	2.87	3.13	6.16	3.67	6.16	6.16	6.15	6.15
2	4.30	5.12	4.93	2.62	3.79	12.38	4.10	12.39	12.39	12.36	12.36
3	4.55	5.50	5.96	3.62	3.02	12.41	4.50	12.38	12.39	12.36	12.36
4	3.93	2.22	2.59	3.32	3.56	6.15	4.02	6.16	6.15	6.14	6.14
5	3.49	1.94	2.34	2.94	3.43	6.16	3.84	6.16	6.16	6.14	6.14
6	--	--	--	--	--	--	--	--	--	--	--
7	3.58	2.65	2.39	4.13	4.25	6.14	4.60	6.15	6.14	6.14	6.14
8	3.06	4.69	5.18	2.65	2.89	11.54	5.87	11.55	11.54	11.52	11.54
9	3.05	3.13	3.88	3.76	4.74	11.55	4.94	11.56	11.56	11.54	11.55
10	2.44	2.96	4.12	4.41	5.23	11.55	5.41	11.56	11.55	11.54	11.54
11	--	3.60	4.68	4.94	5.73	11.54	5.83	11.55	11.54	11.52	11.54
12	4.08	--	4.35	7.93	9.63	12.51	8.85	8.36	11.95	15.55	13.26
13	5.30	4.35	--	6.10	10.24	12.33	7.81	6.68	10.52	14.47	11.09
14	4.24	4.16	3.40	--	4.39	12.41	3.88	12.42	12.39	12.36	12.39
15	4.93	6.57	6.98	4.39	--	12.41	4.96	12.38	12.38	12.38	12.36
16	--	--	--	--	--	--	--	--	--	--	--
17	4.97	6.40	5.33	3.88	4.96	16.72	--	16.78	16.76	16.68	16.68
18	--	--	--	--	--	--	--	--	--	--	--
19	--	--	--	--	--	--	--	--	--	--	--
20	--	--	--	--	--	--	--	--	--	--	--
21	19.22	13.61	11.39	13.46	15.11	11.28	12.28	9.60	9.15	8.56	--

NOTE: -- indicates that no transportation for this crop is defined between these these two regions.

Figure 3 contains a map of the Consuming Regions.

TABLE 8. SORGHUM -- TRANSPORT COST COEFFICIENTS BETWEEN CONSUMING REGIONS ($/1000 lbs.)

TO---→	1	2	3	4	5	6	7	8	9	10
FROM										
1	--	--	--	--	--	--	--	--	--	--
2	2.04	--	3.90	4.06	4.06	5.22	5.01	3.74	2.98	3.40
3	--	--	--	--	--	--	--	--	--	--
4	--	--	--	--	--	--	--	--	--	--
5	--	--	--	--	--	--	--	--	--	--
6	--	--	--	--	--	--	--	--	--	--
7	--	--	--	--	--	--	--	--	--	--
8	--	--	--	--	--	--	--	--	--	--
9	--	--	--	--	--	--	--	--	--	--
10	--	--	--	--	--	--	--	--	--	--
11	--	--	--	--	--	--	--	--	--	--
12	3.11	5.20	5.55	3.30	2.93	4.10	3.81	3.62	2.57	2.46
13	3.46	5.04	5.96	3.74	3.43	4.41	4.11	3.95	3.10	3.26
14	4.06	3.55	6.01	3.93	4.39	5.52	5.29	3.93	3.20	3.45
15	4.32	4.87	4.02	4.73	4.62	5.54	5.35	4.07	3.63	3.95
16	--	--	--	--	--	--	--	--	--	--
17	4.83	5.22	5.65	5.15	4.98	5.81	5.66	4.34	3.76	4.06
18	8.28	7.51	8.37	9.47	8.53	12.00	11.27	10.73	8.34	8.72
19	8.89	7.53	7.93	9.88	9.50	12.37	11.72	11.83	10.25	10.80
20	--	--	--	--	--	--	--	--	--	--
21	11.39	10.35	11.05	12.39	12.05	13.80	13.80	13.34	11.23	11.59

NOTE: -- indicates that no transportation for this crop is defined between these two regions.

Figure 3 contains a map of the Consuming Regions.

TABLE 8. (continued) SORGHUM -- TRANSPORT COST COEFFICIENTS BETWEEN CONSUMING REGIONS ($/1000 lbs.)

TO----	11	12	13	14	15	16	17	18	19	20	21
FROM											
1	--	--	--	--	--	--	--	--	--	--	--
2	3.82	6.10	5.91	3.55	4.87	9.00	5.22	9.11	9.11	8.79	8.79
3	--	--	--	--	--	--	--	--	--	--	--
4	--	--	--	--	--	--	--	--	--	--	--
5	--	--	--	--	--	--	--	--	--	--	--
6	--	--	--	--	--	--	--	--	--	--	--
7	--	--	--	--	--	--	--	--	--	--	--
8	--	--	--	--	--	--	--	--	--	--	--
9	--	--	--	--	--	--	--	--	--	--	--
10	--	--	--	--	--	--	--	--	--	--	--
11	--	--	--	--	--	--	--	--	--	--	--
12	2.91	--	3.07	5.46	6.50	7.33	6.35	5.11	7.05	8.90	7.73
13	3.62	3.07	--	4.33	6.87	5.99	5.39	4.19	6.28	8.35	6.58
14	3.78	5.08	4.24	--	5.53	9.19	4.97	9.37	9.16	8.77	8.92
15	4.29	7.63	8.06	5.53	--	9.34	6.14	8.86	8.88	8.94	8.81
16	--	--	--	--	--	--	--	--	--	--	--
17	4.33	7.45	6.32	4.97	6.14	9.53	--	9.95	9.84	9.23	9.23
18	9.81	5.99	4.85	5.85	9.62	8.34	4.23	--	5.75	7.90	5.46
19	11.76	8.27	7.36	7.20	9.43	3.79	4.74	5.75	--	5.45	5.24
20	--	--	--	--	--	--	--	--	--	--	--
21	12.53	9.05	7.71	9.08	10.06	6.30	8.35	5.46	5.24	4.91	--

NOTE: -- indicates that no transportation for this crop is defined between these two regions.

Fibure 3 contains a map of the Consuming Regions.

TABLE 9. WHEAT -- TRANSPORT COST COEFFICIENTS BETWEEN CONSUMING REGIONS ($/1000 lbs.)

TO----	1	2	3	4	5	6	7	8	9	10
FROM										
1	--	3.88	5.05	5.32	5.32	9.64	8.93	5.22	3.87	4.87
2	1.68	--	3.88	2.43	2.43	3.36	3.18	6.56	4.98	5.86
3	2.19	3.88	--	2.62	2.49	3.39	3.21	6.67	5.54	6.34
4	5.32	5.63	6.06	--	5.40	8.66	8.22	4.79	4.30	4.92
5	5.32	5.63	5.76	5.40	--	8.38	7.75	4.36	3.24	4.05
6	--	--	--	--	--	--	--	--	--	--
7	8.93	7.35	7.43	8.22	7.75	5.47	--	2.98	5.21	4.97
8	8.40	7.16	7.27	7.71	7.02	6.96	4.79	--	2.52	2.41
9	2.76	3.32	3.69	3.07	2.31	4.31	3.72	2.52	--	1.89
10	3.47	3.90	4.23	3.51	2.89	4.19	3.54	2.41	1.89	--
11	4.15	4.51	4.78	4.17	3.69	4.36	3.79	2.47	2.47	2.14
12	4.26	7.19	7.74	4.57	3.98	5.96	5.48	5.55	3.65	3.45
13	4.87	6.93	8.41	5.35	4.81	6.55	6.01	6.16	4.57	4.87
14	2.43	3.51	4.72	2.33	2.69	3.60	3.41	7.00	5.44	5.97
15	2.63	4.92	4.01	2.96	2.86	3.61	3.46	7.31	6.34	7.02
16	11.00	10.43	7.56	12.39	11.93	16.00	15.07	15.25	12.84	14.26
17	3.03	5.28	5.74	3.29	3.16	3.85	3.71	7.90	6.62	7.27
18	10.16	9.27	10.48	11.83	10.52	15.46	14.40	13.63	10.25	10.79
19	--	--	--	--	--	--	--	--	--	--
20	14.45	13.32	12.72	15.87	15.53	18.10	18.10	18.10	15.90	17.21
21	14.59	13.32	14.32	16.02	15.53	18.10	18.10	17.41	14.36	14.85

NOTE: -- indicates that no transportation for this crop is defined between these two regions.

Figure 3 contains a map of the consuming regions.

TABLE 9. (continued) WHEAT -- TRANSPORT COST COEFFICIENTS BETWEEN CONSUMING REGIONS ($/1000 lbs.)

TO----	11	12	13	14	15	16	17	18	19	20	21
FROM											
1	5.81	5.66	6.46	5.64	6.09	19.12	7.02	19.10	19.12	19.16	19.16
2	6.76	8.81	8.98	3.51	4.92	10.50	5.28	10.49	19.49	10.52	10.52
3	7.17	9.49	10.31	4.72	4.01	10.47	5.74	10.50	10.49	10.51	10.53
4	5.85	6.07	7.10	6.42	6.84	19.13	7.62	19.13	19.13	19.19	19.19
5	5.17	5.27	6.39	5.77	6.62	19.13	7.30	19.10	19.13	19.17	19.17
6	--	--	--	--	--	--	--	--	--	--	--
7	5.31	7.27	7.98	7.82	8.00	19.17	8.59	19.16	19.17	19.20	19.20
8	2.47	4.17	4.64	7.27	7.98	11.72	5.27	11.71	11.72	11.73	11.73
9	2.47	2.75	3.44	3.32	4.23	11.70	4.41	11.67	11.70	11.72	11.71
10	2.14	2.60	3.67	3.91	4.68	11.71	4.85	11.68	11.71	11.72	11.72
11	--	3.19	4.17	4.41	5.18	11.72	5.24	11.69	11.72	11.73	11.72
12	4.24	--	4.35	7.60	8.75	12.13	8.51	8.02	11.61	15.15	12.87
13	5.55	4.35	--	5.84	9.87	11.96	7.49	6.37	10.14	14.07	10.71
14	6.67	7.13	5.81	--	5.63	10.47	5.02	10.46	10.48	10.52	10.51
15	7.77	11.36	12.11	5.63	--	10.46	6.27	10.51	10.51	10.51	10.52
16	15.67	10.78	10.63	9.58	7.25	--	7.63	8.64	4.55	6.08	7.95
17	7.86	10.44	9.18	5.02	6.27	12.95	--	12.91	12.92	12.99	12.99
18	12.31	7.13	5.60	7.00	12.25	8.54	4.85	--	7.20	10.21	6.80
19	--	--	--	--	--	--	--	--	--	--	--
20	18.10	13.46	12.51	13.58	11.24	6.08	10.43	10.21	6.78	--	6.05
21	16.22	11.44	9.52	11.48	12.89	7.95	10.45	6.80	6.50	6.05	--

NOTE: -- indicates that no transportation for this crop is defined between these two regions.

Figure 3 contains a map of the consuming region.

TABLE 10. OATS -- TRANSPORT COST COEFFICIENTS BETWEEN CONSUMING REGIONS ($/1000 lbs.)

TO--->	1	2	3	4	5	6	7	8	9	10
FROM										
1	--	2.22	3.07	2.39	2.39	4.89	4.46	3.21	2.28	2.96
2	2.63	--	4.20	4.11	4.11	6.09	5.70	4.55	3.31	3.99
3	3.63	4.20	--	4.50	4.25	6.17	5.78	4.63	3.74	4.37
4	2.39	3.49	3.81	--	2.42	4.30	4.03	2.91	2.57	2.99
5	2.39	3.48	3.59	2.42	--	4.13	3.75	2.61	1.86	2.40
6	--	--	--	--	--	--	--	--	--	--
7	4.46	4.83	4.89	4.03	3.75	3.01	--	1.69	3.20	3.03
8	3.46	3.85	3.91	3.13	2.81	2.79	1.82	--	3.48	3.30
9	3.54	4.34	4.91	3.98	2.88	5.86	4.96	3.48	--	2.42
10	4.59	5.23	5.46	4.63	3.71	5.62	4.69	3.30	2.42	--
11	--	--	--	--	--	--	--	--	--	--
12	4.10	6.95	7.54	4.44	3.80	6.00	5.46	5.08	3.16	2.96
13	4.77	6.67	8.24	5.31	4.71	6.68	6.06	5.74	4.08	4.38
14	4.11	3.65	5.52	3.92	4.85	6.63	6.22	4.88	3.66	4.08
15	4.53	5.85	4.38	5.23	5.02	6.66	6.32	5.14	4.37	4.91
16	10.80	10.01	7.06	12.29	11.80	16.22	15.20	15.41	12.79	14.32
17	5.39	6.48	7.27	5.95	5.66	7.19	6.88	5.62	4.59	5.11
18	--	--	--	--	--	--	--	--	--	--
19	10.83	8.83	9.43	12.34	11.75	16.22	15.20	15.36	12.89	13.74
20	--	--	--	--	--	--	--	--	--	--
21	--	--	--	--	--	--	--	--	--	--

Note: -- indicates that no transportation for this crop is defined between these two regions.

Figure 3 contains a map of the consuming regions.

TABLE 10. (continued) OATS -- TRANSPORT COST COEFFICIENTS BETWEEN CONSUMING REGIONS ($/1000lbs.)

TO-->	11	12	13	14	15	16	17	18	19	20	21
FROM											
1	3.62	2.94	3.42	3.50	3.84	9.24	4.56	9.16	9.24	9.49	9.50
2	4.70	6.82	6.55	3.65	5.85	10.83	6.48	10.71	11.02	11.11	11.11
3	5.03	7.41	8.10	5.52	4.38	10.49	7.27	10.84	10.77	11.05	11.18
4	3.65	3.19	3.81	4.09	4.43	9.35	5.03	9.30	9.35	9.58	9.59
5	2.17	2.72	3.38	3.60	4.24	9.30	4.79	9.19	9.30	9.56	9.56
6	--	--	--	--	--	--	--	--	--	--	--
7	3.26	3.91	4.35	5.19	5.35	9.53	5.82	9.49	9.53	9.70	9.70
8	3.39	5.65	6.36	3.92	4.35	14.78	7.37	14.62	14.78	15.04	14.98
9	3.39	3.51	4.53	4.37	5.73	14.53	6.01	14.20	14.54	14.85	14.70
10	2.82	3.30	4.87	5.25	6.44	14.69	6.70	14.28	14.63	14.97	14.75
11	--	--	--	--	--	--	--	--	--	--	--
12	3.74	--	3.55	7.39	9.18	12.34	8.93	7.83	11.76	15.73	13.16
13	5.08	3.55	--	5.52	9.85	12.14	7.26	6.09	10.14	14.52	10.77
14	4.63	5.41	4.32	--	7.05	10.61	6.01	10.40	10.66	11.13	10.94
15	5.51	9.02	9.68	7.05	--	10.44	8.22	11.01	10.99	10.92	10.07
15	15.87	10.70	10.52	9.14	6.75	--	7.12	7.36	3.47	4.87	6.68
17	5.59	8.22	5.13	6.01	8.22	9.69	--	9.26	9.38	10.00	10.00
18	--	--	--	--	--	--	--	--	--	--	--
19	15.25	10.20	8.81	8.36	11.64	3.47	5.01	5.94	--	5.54	5.27
20	--	--	--	--	--	--	--	--	--	--	--
21	--	--	--	--	--	--	--	--	--	--	--

NOTE: -- indicates that no transportation for this crop is defined between these two regions.

Figure 3 contains a map of the consuming regions.

TABLE 11. BARLEY -- TRANSPORT COST COEFFICIENTS BETWEEN CONSUMING REGIONS ($/1000 lbs.)

TO--→	1	2	3	4	5	6	7	8	9	10
FROM										
1	--	--	--	--	--	--	--	--	--	--
2	--	--	--	--	--	--	--	--	--	--
3	4.66	5.24	--	5.93	5.55	8.41	7.81	6.27	4.99	5.90
4	--	--	--	--	--	--	--	--	--	--
5	--	--	--	--	--	--	--	--	--	--
6	--	--	--	--	--	--	--	--	--	--
7	6.10	7.19	7.32	5.46	5.03	3.94	--	3.51	4.72	4.44
8	4.73	5.77	5.88	4.24	3.79	3.75	2.36	--	3.49	3.28
9	3.40	4.72	5.39	3.88	2.72	5.62	4.92	3.49	--	2.30
10	4.51	5.78	6.37	4.57	3.59	5.64	4.63	3.28	2.30	--
11	--	--	--	--	--	--	--	--	--	--
12	--	--	--	--	--	--	--	--	--	--
13	5.29	8.08	10.13	5.96	5.23	7.65	6.88	6.61	4.56	4.93
14	5.36	4.62	6.69	5.08	6.13	9.11	8.48	6.66	4.88	5.47
15	5.97	7.05	5.44	6.99	6.69	9.16	8.65	7.04	5.90	6.69
16	14.39	16.53	11.42	16.50	15.80	22.14	20.66	20.96	17.20	19.40
17	7.24	7.72	8.56	8.09	7.65	9.99	9.50	7.76	6.22	6.99
18	13.12	14.46	16.63	15.65	13.67	21.29	19.62	18.41	13.26	14.06
19	14.44	14.49	15.51	16.54	15.72	22.14	20.66	20.89	17.34	18.57
20	18.70	21.91	20.78	21.95	21.39	25.52	25.52	25.52	21.99	24.09
21	19.92	21.91	23.79	22.17	21.39	25.52	25.52	24.41	19.55	20.33

NOTE: -- indicates that no transportation for this crop is defined between these two regions.

Figure 3 contains a map of the consuming regions.

TABLE 11. (continued) BARLEY -- TRANSPORT COST COEFFICIENTS BETWEEN CONSUMING REGIONS ($/1000 lbs.)

TO--→	11	12	13	14	15	16	17	18	19	20	21
FROM											
1	--	--	--	--	--	--	--	--	--	--	--
2	--	--	--	--	--	--	--	--	--	--	--
3	6.87	12.74	14.02	6.69	5.44	13.98	8.56	14.77	14.62	15.25	15.55
4	--	--	--	--	--	--	--	--	--	--	--
5	--	--	--	--	--	--	--	--	--	--	--
6	--	--	--	--	--	--	--	--	--	--	--
7	4.83	5.88	6.60	7.85	8.10	14.74	8.91	14.63	14.74	15.19	15.19
8	3.39	8.61	9.80	5.89	6.60	15.51	8.39	15.23	15.50	15.95	15.85
9	3.38	5.12	6.76	4.74	6.37	15.07	6.72	14.52	15.09	15.62	15.35
10	2.74	4.79	7.32	5.79	5.89	15.34	7.55	14.64	15.24	15.83	15.45
11	--	--	--	--	--	--	--	--	--	--	--
12	--	--	--	--	--	--	--	--	--	--	--
13	5.80	5.81	--	6.59	12.23	13.94	8.84	6.67	11.51	16.88	12.28
14	6.27	9.11	7.18	--	8.34	14.26	7.23	13.81	14.51	15.41	14.99
15	7.59	15.74	16.94	8.34	--	13.88	9.57	15.15	15.10	14.94	15.29
16	21.62	14.35	14.10	15.00	10.88	--	11.53	10.02	4.47	6.43	9.03
17	7.70	14.23	12.24	7.23	9.57	12.94	--	12.01	12.26	13.63	13.63
18	16.38	8.84	6.67	10.42	19.89	10.02	6.84	--	7.97	12.35	7.42
19	20.74	13.62	11.66	13.66	19.40	4.47	7.95	7.97	--	7.39	7.01
20	25.52	18.61	17.07	22.39	18.02	6.43	16.53	12.35	7.39	--	6.40
21	22.49	15.38	12.42	18.45	21.12	9.03	16.57	7.42	7.01	6.40	--

NOTE: -- indicates that no transportation for this crop is defined between these two regions.

Figure 3 contains a map of the consuming regions.

TABLE 12. RYE -- TRANSPORT COST COEFFICIENTS BETWEEN CONSUMING REGIONS ($/1000lbs.)

TO--→	1	2	3	4	5	6	7	8	9	10
FROM										
1	--	3.16	4.12	3.15	3.15	5.70	5.28	4.97	3.68	4.63
2	--	--	--	--	--	--	--	--	--	--
3	--	--	--	--	--	--	--	--	--	--
4	--	--	--	--	--	--	--	--	--	--
5	--	--	--	--	--	--	--	--	--	--
6	--	--	--	--	--	--	--	--	--	--
7	--	--	--	--	--	--	--	--	--	--
8	--	--	--	--	--	--	--	--	--	--
9	--	--	--	--	--	--	--	--	--	--
10	--	--	--	--	--	--	--	--	--	--
11	--	--	--	--	--	--	--	--	--	--
12	--	--	--	--	--	--	--	--	--	--
13	--	--	--	--	--	--	--	--	--	--
14	4.89	4.93	6.63	4.69	5.40	7.23	6.85	6.63	5.15	5.66
15	5.29	6.91	5.62	5.95	5.75	7.26	6.95	6.93	6.01	6.66
16	14.20	16.49	11.96	15.99	15.40	20.65	19.45	19.68	16.58	18.41
17	--	--	--	--	--	--	--	--	--	--
18	--	--	--	--	--	--	--	--	--	--
19	14.22	14.70	15.62	16.03	15.34	20.65	19.45	19.63	16.71	17.73
20	18.66	21.06	20.11	20.49	20.04	23.36	23.36	23.36	20.53	22.22
21	--	--	--	--	--	--	--	--	--	--

NOTE: -- indicates that no transportation for this crop is defined between these two regions.

Figure 3 contains a map of the consuming regions.

TABLE 12. (continued) RYE -- TRANSPORT COST COEFFICIENTS BETWEEN CONSUMING REGIONS ($/1000 lbs.)

TO--->	11	12	13	14	15	16	17	18	19	20	21
FROM											
1	5.53	4.61	5.26	4.59	4.96	15.57	5.71	15.55	15.57	15.60	15.60
2	--	--	--	--	--	--	--	--	--	--	--
3	--	--	--	--	--	--	--	--	--	--	--
4	--	--	--	--	--	--	--	--	--	--	--
5	--	--	--	--	--	--	--	--	--	--	--
6	--	--	--	--	--	--	--	--	--	--	--
7	--	--	--	--	--	--	--	--	--	--	--
8	--	--	--	--	--	--	--	--	--	--	--
9	--	--	--	--	--	--	--	--	--	--	--
10	--	--	--	--	--	--	--	--	--	--	--
11	--	--	--	--	--	--	--	--	--	--	--
12	--	--	--	--	--	--	--	--	--	--	--
13	--	--	--	--	--	--	--	--	--	--	--
14	6.32	10.03	8.17	--	7.90	16.56	7.04	16.53	16.57	16.63	16.61
15	7.36	15.98	17.02	7.90	--	16.53	8.80	16.62	16.62	16.61	16.63
16	20.23	13.92	13.72	15.15	11.46	--	12.07	10.19	5.37	7.17	9.38
17	--	--	--	--	--	--	--	--	--	--	--
18	--	--	--	--	--	--	--	--	--	--	--
19	19.54	13.33	11.66	13.96	19.81	5.39	8.73	8.49	--	8.00	7.66
20	23.36	17.38	16.14	21.46	17.78	7.17	16.49	12.04	8.00	--	7.14
21	--	--	--	--	--	--	--	--	--	--	--

NOTE: -- indicates that no transportation for this crop is defined between these two regions.

Figure 3 contains a map of the consuming regions.

TABLE 13. SOYBEANS -- TRANSPORT COST COEFFICIENTS BETWEEN CONSUMING REGIONS ($/1000 lbs.)

TO--→	1	2	3	4	5	6	7	8	9	10
FROM										
1	--	1.13	1.49	1.00	1.00	2.27	1.96	3.25	2.28	2.98
2	1.12	--	3.61	1.83	1.83	2.79	2.60	1.78	1.28	1.55
3	1.59	3.61	--	2.01	1.89	2.82	2.63	1.81	1.45	1.71
4	1.00	1.71	1.88	--	1.01	1.88	1.76	2.93	2.58	3.02
5	1.00	1.71	1.77	1.01	--	1.80	1.62	2.63	1.84	2.39
6	--	--	--	--	--	--	--	--	--	--
7	1.96	2.44	2.47	1.76	1.62	1.28	--	1.67	3.24	3.06
8	1.31	1.67	1.70	1.18	1.06	1.05	0.67	--	2.22	2.08
9	1.97	2.45	2.77	2.23	1.59	3.34	2.80	2.22	--	1.43
10	2.58	2.97	3.26	2.61	2.07	3.19	2.65	2.08	1.43	--
11	3.19	3.51	3.78	3.21	2.77	3.38	2.86	2.15	2.15	1.72
12	4.66	7.93	8.62	5.08	4.31	6.96	6.30	6.08	3.70	3.46
13	5.47	7.60	9.47	6.14	5.40	7.77	7.02	6.89	4.83	5.19
14	1.82	2.97	5.31	1.73	2.08	3.06	2.85	1.92	1.42	1.59
15	2.02	5.74	3.82	2.36	2.26	3.07	2.90	2.02	1.71	1.93
16	--	--	--	--	--	--	--	--	--	--
17	--	--	--	--	--	--	--	--	--	--
18	--	--	--	--	--	--	--	--	--	--
19	--	--	--	--	--	--	--	--	--	--
20	--	--	--	--	--	--	--	--	--	--
21	--	--	--	--	--	--	--	--	--	--

NOTE: -- indicates that no transportation for this crop is defined between these two regions.

Figure 3 contains a map of the consuming regions.

TABLE 13. (continued) SOYBEANS -- TRANSPORT COST COEFFICIENTS BETWEEN CONSUMING REGIONS ($/1000 lbs.)

TO--→	11	12	13	14	15	16	17	18	19	20	21
FROM											
1	3.69	1.26	1.47	1.72	1.90	4.02	2.29	3.98	4.02	4.17	4.17
2	1.84	2.28	2.19	2.97	5.74	4.25	6.62	4.19	4.19	4.39	4.39
3	1.98	2.48	2.72	5.31	3.82	4.08	7.78	4.26	4.22	4.37	4.43
4	3.72	1.37	1.65	2.03	2.22	4.09	2.59	4.06	4.09	4.22	4.22
5	3.21	1.16	1.46	1.77	2.12	4.07	2.41	4.00	4.06	4.21	4.21
6	--	--	--	--	--	--	--	--	--	--	--
7	3.31	1.70	1.89	2.64	2.72	4.19	2.99	4.17	4.19	4.29	4.29
8	2.15	3.05	3.63	1.70	1.89	8.55	4.23	8.43	8.55	8.75	8.70
9	2.13	1.95	2.55	2.46	3.26	8.36	3.42	8.11	8.37	8.60	8.48
10	1.72	1.83	2.75	2.97	3.68	8.47	3.84	8.17	8.43	8.69	8.53
11	--	2.33	3.21	3.42	4.15	8.56	4.21	8.32	8.54	8.75	8.62
12	4.41	--	2.82	8.45	10.58	14.35	10.29	8.98	13.67	18.47	15.34
13	6.08	2.82	--	6.25	11.37	14.12	8.30	6.92	11.72	16.99	12.47
14	1.81	1.79	1.42	--	7.47	4.14	5.97	4.03	4.16	4.40	4.31
15	2.18	3.04	3.27	7.47	--	4.05	9.26	4.34	4.33	4.29	4.37
16	--	--	--	--	--	--	--	--	--	--	--
17	--	--	--	--	--	--	--	--	--	--	--
18	--	--	--	--	--	--	--	--	--	--	--
19	--	--	--	--	--	--	--	--	--	--	--
20	--	--	--	--	--	--	--	--	--	--	--
21	--	--	--	--	--	--	--	--	--	--	--

NOTE: -- indicates that no transportation for this crop is defined between these two regions.

Figure 3 contains a map of the consuming regions.

TABLE 14. COTTONSEED -- TRANSPORT COST COEFFICIENTS BETWEEN CONSUMING REGIONS ($/1000lbs.)

TO--→	1	2	3	4	5	6	7	8	9	10
FROM										
1	--	--	--	--	--	--	--	--	--	--
2	1.08	--	1.45	1.85	1.85	2.97	2.74	1.65	1.14	1.42
3	--	--	--	--	--	--	--	--	--	--
4	--	--	--	--	--	--	--	--	--	--
5	--	--	--	--	--	--	--	--	--	--
6	--	--	--	--	--	--	--	--	--	--
7	--	--	--	--	--	--	--	--	--	--
8	1.78	2.20	2.24	1.58	1.40	1.38	0.84	--	2.78	2.59
9	1.26	1.60	1.85	1.45	0.99	2.23	1.87	2.78	--	1.73
10	1.70	1.99	2.21	1.73	1.34	2.17	1.75	2.59	1.73	--
11	2.16	2.41	2.61	2.18	1.85	2.31	1.91	2.69	2.69	2.13
12	2.02	3.45	3.78	2.23	1.85	3.16	2.83	2.61	1.50	1.39
13	2.42	3.30	4.19	2.75	2.38	3.59	3.20	2.99	2.02	2.19
14	--	--	--	--	--	--	--	--	--	--
15	--	--	--	--	--	--	--	--	--	--
16	--	--	--	--	--	--	--	--	--	--
17	--	--	--	--	--	--	--	--	--	--
18	4.72	4.14	4.80	5.68	4.93	7.84	7.19	5.05	3.57	3.81
19	5.21	4.16	4.47	6.02	5.71	8.16	7.60	5.76	4.74	5.09
20	--	--	--	--	--	--	--	--	--	--
21	7.31	6.42	7.01	8.18	7.88	9.48	9.48	6.79	5.37	5.60

NOTE: -- indicates that no transportation for this crop is defined between these two regions.

Figure 3 contains a map of the consuming regions.

TABLE 14. (continued) COTTONSEED -- TRANSPORT COST COEFFICIENTS BETWEEN CONSUMING REGIONS ($/1000 lbs.)

TO--->	11	12	13	14	15	16	17	18	19	20	21
FROM											
1	--	--	--	--	--	--	--	--	--	--	--
2	1.71	2.31	2.21	1.23	2.15	5.28	2.43	5.15	5.16	5.58	5.58
3	--	--	--	--	--	--	--	--	--	--	--
4	--	--	--	--	--	--	--	--	--	--	--
5	--	--	--	--	--	--	--	--	--	--	--
6	--	--	--	--	--	--	--	--	--	--	--
7	--	--	--	--	--	--	--	--	--	--	--
8	2.69	2.05	2.50	2.25	2.54	6.10	2.97	5.94	6.09	6.33	6.28
9	2.69	1.25	1.69	1.61	2.21	5.87	2.34	5.58	5.88	6.15	6.01
10	2.13	1.16	1.83	2.00	2.54	6.01	2.65	5.64	5.95	6.26	6.06
11	--	1.52	2.18	2.34	2.90	6.13	2.94	5.81	6.08	6.33	6.18
12	1.82	--	1.90	3.70	4.73	6.59	4.26	3.96	6.25	8.67	7.09
13	2.61	1.90	--	2.67	5.12	6.47	3.64	2.98	5.29	7.91	5.66
14	--	--	--	--	--	--	--	--	--	--	--
15	--	--	--	--	--	--	--	--	--	--	--
16	--	--	--	--	--	--	--	--	--	--	--
17	--	--	--	--	--	--	--	--	--	--	--
18	4.47	2.64	1.97	2.95	5.79	4.78	1.89	--	1.93	2.71	1.83
19	5.72	4.17	3.53	3.91	5.65	1.24	2.22	1.93	--	1.82	1.75
20	--	--	--	--	--	--	--	--	--	--	--
21	6.22	4.74	3.78	5.36	6.17	2.13	4.79	1.83	1.75	1.63	--

NOTE: -- indicates that no transportation for this crop is defined between these two regions.

Figure 3 contains a map of the consuming regions.

TABLE 15. Barge Cost Coefficients and Constraints on Total Shipments.
(from Taylor (1975))

From Consuming Region*	To Consuming Region*	Cost/1000 lbs.								Total Shipments of all Commod. allowed. (1000's lbs.)
		Corn	Barley	Wheat	Oats	Sorghum	Rye	Cotton-seed	Soybeans	
1	12	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	19,353,000
2	12	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	15 334,000
3	12	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	11,201,000
5	12	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	4,445,816
9	12	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	5,985,000

* Figure 3 contains a map of the Consuming Regions.

Table 16. Lower Bounds on Cotton Acreage, by Producing Region.

Producing Region	Lower Bounds (acres)	Producing Region	Lower Bounds (acres)
N.C.		S.C.	
5	54,807	30	153,802
6	67,794	31	109,065
7	34,774	32	67,534
8	59,403	Ark.	
Tenn.		33	83,566
11	69,242	34	36,165
12	128,577	35	76,253
13	14,741	36	40,818
14	9,827	37	91,144
15	20,106	38	107,764
Ala.		39	141,470
17	18,831	40	87,554
18	81,663	La.	
19	63,631	41	64,672
20	21,367	42	84,884
21	14,229	43	52,534
22	29,115	44	33,297
23	151,681	45	43,041
24	89,083	Ms.	
Fla.		46	119,510
25	15,200	47	156,871
Ga.		48	97,154
26	33,032	49	66,684
27	88,125	50	64,004
28	127,634	51	19,217
29	155,970	52	30,930
		53	11,790

Table 17. Exogenous Crop Acres by Consuming Region.

Consuming Region	Cotton	Corn	Soybeans	Wheat	Sorghum	Small Gr.
1	-	-	-	-	-	35
2	-	-	-	7	-	31
3	-	2	-	2	-	33
4	-	-	34	-	-	23
5	-	-	9	-	-	44
6	-	-	-	-	-	-
7	-	-	11	-	-	60
8	30	-	30	17	69	119
9	68	-	65	7	50	97
10	-	13	39	38	80	163
11	-	18	-	-	-	11
12	-	1	48	53	123	27
13	374	430	315	270	221	754
14	-	0	99	280	-	22
15	-	11	28	2	1	2
16	-	39	-	551	-	420
17	-	22	-	301	10	99
18	5	34	-	91	56	33
19	-	13	-	268	-	166
20	-	62	-	709	-	301
21	48	97	-	161	56	374

Table 18. Exogenous Acreage plus Base Solution Acreage Compared with Actual 1973 Acreage, by Consuming Region.

Consuming Region	Cotton		Corn		Soybns	
	Base	1973	Base	1973	Base	1973
1	-	-	7,764	9,530	8,574	9,000
2	179	241	6,849	13,880	10,892	12,600
3			4,123	7,610	3,123	4,666
4			492	1,690	34	700
5			5,697	8,280	3,744	7,930
6						
7			3,816	2,161	11	597
8	247	189	2,575	2,013	30	1,930
9	310	461	2,323	1,543	286	2,820
10	1,205	1,241	1,162	2,710	39	3,270
11	15	13	337	340	319	340
12	2,224	2,945	2,212	234	2,141	9,150
13	7,785	5,979	1,671	727	1,322	660
14			8,115	7,440	4,116	2,470
15			4,359	2,890	8,574	620
16			39	39		
17			393	463		
18	258	460	34	34		
19			13	13		
20			62	62		
21	418	950	1,345	235		
TOTAL	12,661	12,479	52,681	61,894	43,205	56,753

Table 18. (continued)

Consuming Region	Wheat		Sorghum		Sm. Gr.	
	Base	1973	Base	1973	Base	1973
1	105	1,390	2,416	60	307	465
2	2,631	1,020	5,300	462	629	1,397
3	4,174	2,085			7,685	2,934
4	2,656	585			2,124	386
5	3,849	1,495	1,554	25	1,809	845
6						
7	2,602	442			750	1,194
8	1,230	631	69	88	118	344
9	559	448	40	40	99	114
10	90	425	80	80	785	345
11		55			11	11
12	651	500	143	205	918	95
13	11,922	10,000	4,790	7,646	5,570	1,266
14	18,149	13,000	4,491	5,900	1,707	758
15	8,892	11,458	36	262	10,172	7,678
16	5,336	5,435			2,268	3,150
17	2,372	2,820	141	285	2,177	520
18	172	626	217	503	33	33
19	268	268			166	166
20	4,212	4,445			301	752
21	1,995	627	640	287	467	1,050
TOTAL	77,866	58,955	19,907	15,843	38,292	25,503

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APPENDIX A

BUDGET UPDATE PROCEDURE

Whenever possible, variable costs and average yields were taken from the Farm Enterprise Data System developed by specialists at the Oklahoma State University (Garst, 1975). However, these were not available for certain areas in the United States. For several of these regions, viz. the Delta States (Ark., La., and Miss.), the Northwest (Wash., Ore., Idaho), and the Southwest (Cal., Ariz., N. Mex.), it was possible to use the previously published APAS budgets (Stricklan and Harwell, 1971; Pawson, 1973; and Rude, 1971). A similar situation arose with respect to New York, Pennsylvania, New Jersey, Delaware, Maryland, parts of other states in the South East and parts of California. The basic budgets used there were derived by C.R. Taylor and E.R. Swanson (1975). All of these budgets were based on 1970 prices. Since 1973 was the base year chosen for the present study, these budgets had to be updated to reflect price changes during the 1970-73 period.

The first step in the update procedure involved examining all the budgets which were to be updated to derive a comprehensive list of budget items. A list of 37 general budget item categories was derived in this manner and this list is shown in Table A1. The general nature of the list is emphasized and the exact description of the items referred to can be found only in the original APAS publications. While a more specific item list would have been more desirable, it was not possible to develop a computer program to handle such a list in the time available.

The major problem in the update procedure involved obtaining price data for each of the budget items. Since the prices used in the original budgets reflected intrastate price variation and since official price data is published only at the state level, it was not possible to directly include 1973 prices in the updated budgets. Therefore, 1970 and 1973 published prices (USDA, 1971, 1974a) were used to obtain percent change data and these percentages used to update the budget prices. The following sections describe in detail the derivation of these update ratios for each of the items involved.

LABOR, SEED AND FERTILIZER COSTS

Percentage data for these items were obtained by a simple comparison of 1970 and 1973 prices. In dealing with labor costs comparability was maintained by using "Rate per hour without room and board". Data on seed costs was obtained by State for Spring Wheat, Winter Wheat, Oats, Spring Barley, Winter Barley, Soybeans, Cotton, Corn, and Sorghum. No data were

available for Rye and Peas, but data for Oats and Barley, respectively, were used where necessary.

Data on fertilizer costs were obtained by state for Urea, Super Phosphate, Muriate of Potash and Lime, and these were used for all N, P, and K fertilizers and lime respectively. National data were used for 0-20-20, 6-12-12 and 10-10-10, while data on Sulphate of Ammonia and Magnesium lime were substituted for Sulphur and Gypsum, respectively.

These data, expressed as a ratio, are shown in Table A5 for all states where updated budgets were required.

MACHINERY, EQUIPMENT AND CUSTOM HIRE COSTS

Data on machinery, equipment and custom hire costs per se are not published. However, annual price data by state are published for the individual items which are used directly for the operation of farm machinery and equipment (e.g. diesel fuel, lubrication oil, tires, batteries, etc). A total of 18 items was used. The change in the price of each of these items between 1970 and 1973 was then weighted by the relative weight assigned to each item in the 1974 Parity Index. (USDA, 1974b)

These items, the parity index value for each and the weight used in the calculations described here, are shown in Table A2. The final update ratios used are shown in Table A5. These ratios are used to update all machinery and equipment costs and all custom hire costs in the budgets.

The use of these ratios to update custom hire costs is not easily justified since it is equivalent to assuming that custom hire charges vary in direct proportion to machinery operation and maintenance cost and takes no account of the fact that labor and machinery investment costs are also important. However a more sophisticated analysis which would take these factors into account was not possible in the time available.

HERBICIDE COSTS

Published price data were used to obtain price change ratios for Atrazine, 2,4-D, and 2,4,5-T, and these ratios were applied to the budgets where appropriate.

INSECTICIDE COSTS

The major problem in updating insecticide costs was the discrepancy between the number of insecticide materials actually used and the number of materials for which published prices were available. This problem was further complicated by the fact that the original budgets did not identify the specific material to which the insecticide cost item(s) referred.

It was therefore necessary to find a general insecticide cost index. Since each crop uses different materials in different proportions a different index was required for each crop. Also, since insecticide use on any given

crop, and insecticide prices, vary by location, different indices are required for different parts of the United States.

Data on insecticide use by crop and by region were obtained from Andrilenas (1975). These data were combined with acreage data to show per acre use of the three main insecticide types (Organochlorines, Organophosphates, and Carbamates), on each crop endogenous to the model, for each of ten Major Agricultural Regions in the United States. (Table A3). From the list of insecticide materials for which published prices were available, certain materials were chosen to represent each type of insecticide. Toxaphene was chosen to represent the Organochlorine compounds since this was the only O.C. material which could legally be used in most states in 1973. Parathion and Malathion were chosen to represent the Organophosphate compounds and their average price change was used. The Carbamates were represented by Carbaryl since this was the only carbamate material for which price data were available.

The prices of these materials were adjusted to prices per lb. of active ingredient and the proportionate price change between 1970 and 1973 was calculated for each state. These price changes were then weighted by the appropriate application rate and summed to obtain an index of the change in insecticide cost between 1970 and 1973 for each crop in each state. These indices are shown in Table A5.

IRRIGATION COSTS

Detailed data on the operating costs of irrigation schemes have been published by the U.S. Department of the Interior (1974a, 1974b). Using these data it was possible to calculate weighted average cost per acre for irrigation schemes in each of 16 western states for 1970 and 1973. These cost data were then used to obtain proportionate changes in cost between the two years. These change ratios are shown in Table A5.

CROP INSURANCE COSTS

In calculating the changes in crop insurance costs between 1970 and 1973 it is assumed that all insurance is under the Federal Crop Insurance Corporation. This is not strictly accurate, but data on the costs of private insurance are not available. However, these can be assumed to change in the same proportion as Federal Insurance costs.

Long run policy of the Federal Crop Insurance Corporation is to maintain an average loss ratio of 0.90 (Federal Crop Insurance Corporation 1975). If it is assumed that long run weather conditions are stable, this means that the cost per $1000 insurance coverage does not change in the long run. However, cost per acre will change as the value of the crop insured changes. For this reason, the index of all crop prices received by farmers is used to approximate the trend in crop insurance costs. This gives a ratio of 1.64 for changes between 1970 and 1973. This ratio was used to update insurance costs in all budgets. It is inaccurate in that it includes the effect of changes in the price of crops which are exogenous to the model (e.g. tobacco, fruit and vegetables). However, it is felt that this

inaccuracy is minimal.

GRAIN STORAGE COSTS

Data for grain storage costs were obtained from data published by the Economic Research Service, USDA (Schienbien and Vosloh, 1973). These data indicated that average storage costs remained unchanged between 1970-71 and 1971-72 while the storage costs at county elevators rose by 16% between 1971-72 and 1973-74. These figures take full account of changes in utilization levels. Since no data were available by state, an update ratio of 1.16 was used for grain storage cost in all budgets.

COTTON GINNING COSTS

A major study of cotton ginning charges, covering the period 1955-56 through 1970-71 (Ghetti and Looney, 1972), identified the major factors related to the change in cotton ginning charges as:

(a) Change in the proportion of the cotton crop harvested mechanically.
(b) Change in total volume of cotton production.
(c) Change in the number of active gins.
(d) Increase in the amount of cleaning and drying equipment required.
(e) Change in the proportion of the cotton crop purchased by ginners.

More recent studies of cotton ginning costs (Looney, Holder and Ghetti, 1972; Wilmot, Shaw and Heron, 1973; Wilmot, Shaw and Heron, 1975) have concentrated on particular areas, but these do not provide all the information required.

Change in cotton ginning costs is therefore estimated indirectly. To simplify this process it is assumed that:

(a) Proportion of cotton harvested mechanically has not changed substantially in the 1970-73 period. This assumption is valid since 98% of the cotton was being harvested mechanically in 1970.
(b) The number of active gins has not changed between 1970 and 1973.
(c) The proportion of the crop purchased by the ginners has remained unchanged.

Assumptions (b) and (c) are necessary in the absence of any other information.

If it is also assumed that ginning charges are directly related to ginning costs then ginning charges for 1970 can be written as:

(1) $C = L + M + F$ where

C = Ginning charges for 1970

L = Component of C related to labor costs

M = Component of C related to machinery costs

F = Component of C related to fixed costs.

Charges for 1973 can then be written as

(2) $Cx = Lx_1 + Mx_2 + Fx_3$ where

x = proportionate change in total charges

x_1 = proportionate change in labor costs

x_2 = proportionate change in machinery operating costs

x_3 = proportionate change in fixed costs

between 1970 and 1973.

Equation (2) can be rewritten as

(3) $x = \frac{L}{C} x_1 + \frac{M}{C} x_2 + \frac{F}{C} x_3$

Assuming that labor and machinery costs at ginning facilities have risen at the same rate as these costs have for farmers, values by state for x_1 and x_2 can be obtained from Table A5. If it is also assumed that the number of gins and investment per gin have not changed, the value of x_3 will be given by the inverse of the change in cotton production between 1970 and 1973. Values for the proportions of total costs represented by labor, machinery operation and fiscal costs were obtained from USDA publications (Looney, Holder and Ghetti, 1972; Wilmot, Shaw and Heron, 1973; Wilmot, Shaw and Heron, 1975). These data are shown in Table A4, for all cotton producing states in the model.

MISCELLANEOUS COSTS

All miscellaneous cost items were increased by 13%. This is the percentage rise in the "Farm Supplies" cost index during the 1970-73 period. (U.S.D.A., 1971; U.S.D.A., 1974a).

INTEREST CHARGES

It was assumed that short-term interest rates did not change between 1970 and 1973. Interest was charged on all preharvest expenses including all labor costs. This differed from what had been done in some of the original budgets but was consistent with others.

TABLE A1.

Item List Used in Updating the APAS Budgets

#	ITEM CATEGORY	#	ITEM CATEGORY
1	Preharvest Labor I	20	Miscellaneous
2	Preharvest Labor II	21	Interest
3	Preharvest Labor III	22	TOTAL PRE-HARVEST COST
4	Seed	23	Harvest Labor I
5	Fertilizer I	24	Harvest Labor II
6	Fertilizer II	25	Harvest Labor III
7	Fertilizer III	26	Harvest Equipment I
8	Fertilizer IV	27	Harvest Equipment II
9	Preharvest Equipment I	28	Harvest Equipment III
10	Preharvest Equipment II	29	Harvest Custom Hire I
11	Preharvest Equipment III	30	Harvest Custom Hire II
12	Preharvest Equipment IV	31	Harvest Custom Hire III
13	Preharvest Custom Hire I	32	Grain Storage
14	Preharvest Custom Hire II	33	Other Harvest Cost I
15	Preharvest Custom Hire III	34	Other Harvest Cost II
16	Pesticide I	35	Other Harvest Cost III
17	Pesticide II	36	TOTAL HARVEST COST
18	Irrigation Water	37	TOTAL VARIABLE COST
19	Insurance		

TABLE A2. Items used in updating Machinery, Equipment and Custom Hire Costs, the Parity Index Value and the weights used for each.

ITEM	PARITY INDEX[1] VALUE	WEIGHTS
Gas - Filling Station	1.53	.204
Gas - Bulk Delivery	3.55	.472
Diesel Fuel	.53	.070
Oil - regular non-detergent	.13	.017
Oil - heavy duty detergent	.12	.016
Oil - all weather	.10	.013
Grease - 35 lb pail	.11	.015
Tires - Auto, bias-belted	.07	.009
Tires - Auto, conventional	.07	.009
Tires - Truck, 6 ply	.06	.008
Tires - Truck, 10 ply	.07	.009
Tires - Tractor, 4 ply	.13	.017
Batteries - 6 volt	.04	.006
Batteries - 12 volt	.07	.009
Spark plugs	.04	.006
Anti-freeze - permanent	.04	.006
Services - Chassis lubrication	.74	.098
Services - Motor tune-up	.12	.016

[1] Source: U.S.D.A. Crop Reporting Board "Agricultural Prices, August Supplement 1" August 1974.

TABLE A3.

AVERAGE INSECTICIDE APPLICATION PER ACRE FOR SELECTED CROPS BY REGION AND TYPE OF INSECTICIDE 1971.

(lbs A.I. per acre)

PESTICIDE / CROP	REGION									
	NORTH-EAST	LAKE STATES	CORN BELT	NOR'N PLAINS	APPAL.	SOUTH-EAST	DELTA STATES	SOUTH. PLAINS	MT.	PAC.
ORG. PHOS.										
CORN	.0184	.0541	.0943	.3436	.0516	.0050	.0010	.0551	.7248	.0605
COTTON			.1111		1.2273	5.0093	4.2555	1.2387	1.5843	1.0565
WHEAT				.0017	.0009	.0003		.1544	.0030	.0467
SORGHUM			.0043	.1558	.0228	.0063	.1922	.2910	.2825	.5438
OTH. GRNS.	.0051	.0011	.0023		.0007		.0387	.0875	.0005	.0199
SOYBEANS	.0085		.0006		.0449	.2429	.1972	.0632		
ORG. CHLOR.										
CORN	.0082	.0264	.2580	.0541	.0143	.0074	.0698	.0012	.0187	.0639
COTTON					4.2227	13.8282	5.3540	.5475	2.5213	
WHEAT					.0009		.0448	.0005	.0005	.0028
SORGHUM			.0750	.0001	.0076	.0158	.0977	.0096	.0068	
OTH. GRNS.	.0023		.0154	.0001	.0073		.0423			.0002
SOYBEANS			.0002		.0374	.5623	.0141			
CARBAMATES										
CORN	.0184	.1465	.0778	.4701	.0142		.0019	.0098	.0837	.0107
COTTON					.0968	.6750	.0204	.0899	.0854	
WHEAT							.0852	.0068		
SORGHUM				.0034	.0431	1.2658	.2622	.0302	.0098	
OTH. GRNS.		.0268	.0036			.0029	.0423	.0034		
SOYBEANS	.0508		.0035		.1762	.1947	.0109	.0186		

Adapted from Andrilenas, 1975.

Table A4. Data used in calculating cotton ginning costs for 1973.

States	L/C	M/C	F/C	X_1	X_2	X_3	X Value
*Ala.	.204	.484	.312	1.282	1.198	1.129	1.194
Fla.				1.157	1.257	0.592	1.029
*Ga.				1.260	1.244	0.749	1.093
*N.C.				1.250	1.247	0.945	1.153
*S.C.				1.286	1.262	0.728	1.100
*Va.				1.240	1.197	1.545	1.314
Ark.	.204	.484	.312	1.246	1.235	1.007	1.666
La.				1.206	1.236	1.000	1.156
Miss.				1.224	1.212	0.881	1.111
Mo.				1.242	1.260	1.244	1.251
*Tenn.				1.299	1.220	0.907	1.133
Okla	.183	.444	.373	1.230	1.241	0.452	0.945
Texas				1.230	1.241	0.452	0.945
Ariz	.163	.422	.415	1.216	1.228	0.802	1.049
Cal				1.179	1.224	0.663	0.984
N. Mex.				1.197	1.218	1.051	1.145

*No cotton budgets needed updating in these states.

TABLE A5. RATIOS USED TO UPDDATE THE 1970 BUDGETS

STATE	LABOR	SEED									FERTILIZER				MACHINERY & EQUIPMENT CUSTOM HIRE
		SPRING WHEAT	WINTER WHEAT	OATS	SPRING BARLEY	WINTER BARLEY	SOYBEANS	COTTON	CORN	SORGHUM	UREA	SUPER PHOSPHATE	MURIATE OF POTASH	LIME	
N.Y.	1.143		2.74	1.35	1.05				1.43		1.09	1.29	1.18	1.10	1.205
PA. etc.	1.191		2.72	1.28	1.17	1.96	1.96		1.53		1.16	1.24	1.20	1.24	1.225
VA etc.	1.240		3.00		1.29	1.88	1.94		1.44		1.06	1.20	1.15	1.01	1.239
KY	1.174		2.59		1.02		2.20		1.50	1.21	1.08	1.11	1.05	1.05	1.197
TENN	1.299		2.88		(1.27)*		2.60	1.06	1.92	1.16	1.15	1.24	1.20	1.15	1.220
N.C.	1.250		3.03		1.27		2.17	1.13	1.61	1.37	1.11	1.27	1.26	1.09	1.247
S.C.	1.286						2.14	1.17	1.56	1.11	1.10	1.27	1.15	1.19	1.262
GA	1.260						2.13	1.22	1.49	1.14	1.09	1.26	1.11	1.20	1.244
FLA	1.157		(3.03)*				2.11	(1.22)*	1.53		0.98	1.22	1.03	1.28	1.257
ALA	1.282						2.30	1.26	1.47	1.15	0.96	1.28	1.13	1.16	1.198
MO.	1.242		2.69	1.24			2.15	1.00	1.50	1.07	1.12	1.00	1.18	0.97	1.260
MISS	1.224						2.46	1.19	1.43	1.24	0.90	1.25	1.15	1.22	1.212
ARK	1.246		2.71				2.53	1.16	1.29	1.21	1.06	1.31	1.19	1.27	1.235
LA	1.206						2.45	1.12	1.93	1.28	1.01	1.24	1.16	1.22	1.236
OKLA	1.230		2.36	1.25	1.81	1.86	2.31	1.07	1.42	1.16	1.07	1.23	1.24	0.89	1.241
TEX	1.268		2.53	1.19	1.54	2.08	2.24	1.23	1.29	1.18	1.04	1.31	1.31	1.11	1.209
MONT	1.258	1.46	2.70	1.29	1.19	2.40			1.12				1.11		1.156
IDAHO	1.279	1.71	2.79	1.38	1.40	2.43			1.12		1.12	1.00	1.00		1.206
WYO	1.275	1.55		1.43	1.37	2.00			1.03				1.30		1.157
COLO	1.216	1.26	2.40	1.39	1.38	1.96			1.47	1.30	1.04		1.23		1.199
N. MEX	1.197				1.56			1.15	0.98	1.19	1.09	1.06	1.05		1.218
ARIZ	1.216		2.50			2.61		1.20		1.15	1.02	1.00	1.20		1.228
WASH	1.153	2.02	2.59	1.38	1.36	3.27			1.15		1.13	1.25	1.23		1.224
ORE	1.197	1.48	2.65	1.42	1.50	2.00			1.14		1.09	1.06	1.07		1.181
CAL.	1.179	1.21	2.52	1.25	1.23	2.29		1.07	1.38	1.19	1.09	1.02	1.02		1.224

*No data available - data from a nearby state was used.

TABLE A5. (Continued)

STATE	HERBICIDES			INSECTICIDES BY CROP						IRRIGATION WATER	COTTON GINNING
	ATRAZINE	2,4-D	2,4,5-T	CORN	COTTON	WHEAT	SORGHUM	OTHER SM. GRNS	SOYBEANS		
N.Y.	1.00	1.329	1.136	1.054				1.073	1.039		
PA etc.	1.011	1.147	1.205	1.144				1.079	1.219		
VA etc.	1.018	1.104	1.121	0.915	0.868	0.898	1.107	0.848	1.045		1.314
KY	1.000	1.150	1.000	1.051	1.153	1.109	1.033	1.179	1.041		
TENN	0.962	1.300	0.952	1.058	1.059	1.055	1.071	1.060	1.077		1.138
N.C.	0.960	1.239	1.094	1.138	1.265	1.199	1.155	1.300	1.176		1.153
S.C.	1.090	1.035		1.188	1.209	1.076	1.090	1.090	1.183		1.100
GA	1.907	1.138		1.130	1.139	1.081	1.113	1.114	1.131		1.093
FLA	1.000	1.194	1.000	1.125	1.149	1.053	1.092	1.093	1.127		1.029
ALA	0.981	1.290		1.151	1.157	1.111	1.110	1.111	1.140		1.194
MO	1.022	1.192		1.058	0.998			1.081	1.046		1.251
MISS	0.946	1.038	1.150	0.864	0.918	1.011	1.112	1.084	1.005		1.111
ARK	0.867	1.448	1.170	1.095	1.016	0.912	0.986	1.004	0.925		1.166
LA	0.895	1.111	1.100	1.087	1.047	0.985	0.966	0.994	0.991		1.156
OKLA	1.020	1.233	1.120	1.086	1.106	1.072	1.081	1.042	1.091	0.877	0.945
TEX	0.941	1.212	1.250	1.088	1.069	1.084	1.085	1.085	2.175	1.397	1.063
MONT	1.018	1.345		0.955	0.912	0.935	0.946	0.944		1.242	
IDAHO	1.018	1.238		0.977	1.115	0.994	0.967	0.956		1.107	
WYO	1.018	1.197		1.015	0.960	1.000	1.001	1.012		1.067	
COLO	1.018	1.046		0.979	1.003	0.974	0.971	0.965		1.122	
N. MEX	1.018	1.279		1.036	1.133	1.057	1.036	1.032		0.994	1.145
ARIZ	1.018	1.067		0.971	1.138	0.999	0.965	0.954		1.127	
WASH	1.017	1.453		1.114	0.964	0.975	0.956	0.959		1.033	
ORE	0.929	1.189		1.053	1.051	1.045	1.043	1.043		1.124	
CAL	1.035	1.243		1.022	1.048	1.053	1.043	1.045		1.218	0.984

APPENDIX B

DERIVING THE ACREAGE CONSTRAINTS

A principal limitation of past studies utilizing Linear Programming models has been the assumption of homogeneous yield throughout each producing region, leading inevitably, in the model solutions, to the absence of major crop production in entire producing regions. It was decided in this study, therefore, to subdivide each producing region into a reasonable number of soil classes for which differential productivity could be estimated.

This was accomplished by using a classification scheme developed by The Soil Conservation Service. In their classification, eight soil classes, ranging from the best or most productive class I to the least productive class VIII, are delineated.

All classes except Class I are divided into four subclasses depending on the dominant production limitations on that particular soil. The limitations recognized at this level are erosion hazard (or the effects of past erosion) (E), excess water (W), rooting zone limitation (S), and unfavorable climatic conditions (C).

Soils in the first four classes are capable of producing the common cultivated crops under good management. Soils in classes V, VI and VII are capable of producing adapted native plants while soils in class VIII do not return on-site benefits to management inputs for crops, grasses, and trees without major reclamation.

The capability classification is based on the effects of a combination of permanent soil characteristics and climate on current agricultural productivity. It was not developed as a productivity rating. Within a particular class soils are similar only with respect to limitations in use. The capability classification is not intended to be generalized as regards suitability for crops or other management needs. (However, the Soil Conservation Service has developed relative yield data at the soil subclass level; see Section C below.)

A moderately high level of management is assumed in defining limitations, but no inference is made as to what is the most profitable use. In addition, the capability classification is not based on the cultivation practices recommended for use. It is based only on <u>degree</u> of aggregate limitations, and the <u>kind</u> of practices required to work with these limitations may vary more within classes than between classes.

Only permanent limitations are considered. Soils which have some temporary limitations (e.g., removable forest cover) are classified according to their permanent limitations after removal of all temporary limitations. Differences in costs of this removal do not affect classification. Finally, the capability groupings are subject to change due to (a) major projects which modify the effective permanent limitations, and (b) new information on behavior and response of soils.

Within this classification scheme the capability classes may be described as follows: (Soil Conservation Service, 1961).

Class I. These soils have few limitations that restrict their use. They are nearly level with no erosion hazard and are deep, well-drained and easily worked. They need ordinary management practices to maintain fertility and structure. In certain cases improvement may be desirable to increase productivity and ease of operation.

Class II. These soils have some limitations restricting choice of plants or they require moderate conservation practices. However, the limitations are few and the practices are easy to apply. The limitations include:

1. gentle slopes
2. moderate erosion hazard
3. less than ideal depth
4. unfavorable structure
5. moderate recurring salinity
6. occasional flooding
7. wetness
8. slight climatic limitations

Required practices include:

1. terracing, strip cropping, contouring
2. grass rotations
3. cover crops, mulching
4. fertilizers, manure, lime

Class III. These soils have severe limitations on the choice of crops and/or may require special conservation practices. The restrictions are more limiting than in Class II and the practices are usually more difficult to apply. The limitations include:

1. moderately steep slopes
2. high erosion hazard
3. frequent flooding
4. low permeability and wetness
5. shallow depth and susceptibility to pan formation
6. low moisture holding capacity
7. low natural fertility
8. moderate salinity
9. moderate climatic limitations

Required practices are those required to maintain soil structure. Drainage may also be necessary.

Class IV. These soils have very severe restrictions on the choice of

plants and/or require very careful management. They may be suited to only two or three crops and yields may be much lower than on other soils. Limitations include:

1. steep slopes
2. severe erosion hazard
3. severe effects of past erosion
4. shallow soils
5. low water-holding capacity
6. frequent flooding
7. excessive wetness
8. severe salinity
9. moderately adverse climate

The practices required usually involved those required to deal with wet, heavy soils, or those required to prevent wind erosion.

Classes V, VI, VII, and VIII are suitable only for pasture range and woodland.

The acreage data used to determine the land available for production in each soil class within each producing region were obtained from the updated version of the Conservation Needs Inventory. This inventory contains a total of eleven sets of tables; only two of these were used, set A, giving acreages of irrigated land, and set B, giving acreages of both irrigated and dry land. Each set consists of up to 29 separate tables, for each county of the continental United States, giving 1973 acreages of all crops for each of the 29 soil subclasses possible within each county. (Gray 1975).

Each table contains a series of identifying data, which establish the type of table (A-N), the soil class, subclass, and the county covered by the table, as well as the various land groupings into which the county falls, of which the LRA (Land Resource Area) is the most significant. (Other groupings include the Land Resource Region, several Water Resource Regions, and some SMSA and ERS classifications.) Following this identification section are 10 numerical fields, which contain (for Table B) the estimated total acreages of the following crop groups:

1. Corn and Sorghum
2. Other Row Crops (Cotton, Tobacco, Soybeans, etc.)
3. Close Grown Crops (Wheat, Oats, Barley, Rye, etc.)
4. Summer Fallow
5. Rotation Hay and Pasture
6. Hayland
7. Conservation Use Only
8. Temporarily Idle Cropland
9. Orchards, Vineyards, and Fresh Fruit
10. Open Land Formerly Cropped

Table A is similar, but for irrigated cropland only. The land constraints were created using only the first 4 crop groups, as it is this land which can be quickly put into the major field crops endogenous to the model. Hay and pasture are exogenous to the model.

These acreages were aggregated among the counties in each producing region, and the results are listed in tables 2 and 3 above.

APPENDIX C

YIELD COEFFICIENTS

As mentioned above in Appendix B, four soil capability classes were delineated for each producing region. Although the production cost was assumed constant over the range of land classes, the yields given in each crop budget were average yields, and therefore had to be disaggregated.

To accomplish this, relative yield data from the Soil Conservation Service were obtained. The basic land unit for which these data were collected is the Land Resource Area (LRA). The land area of the continental United States is divided into 153 LRAs, organized primarily along major soil groupings (USDA 1972). Each county is assigned by the Conservation Needs Inventory to one LRA depending on its principal soil characteristics.

For each LRA, relative yield data on up to five crops or crop groups--Corn, Sorghum, Small Grains, Soybeans, and Cotton--were collected for several subclasses, although in no case were complete data given. For each crop, the highest subclass chosen received the value 100%, while the values of subclasses below this one reflected its crop yield as a percent of the yield of the highest subclass.

The following procedures were used to approximate relative yield percentages when data were missing.

(1) If data were missing for a class with a particular limitation, but data for a higher class were given, and if data for other limitations were present in both classes, a simple ratio was used to approximate the missing data. An example will illustrate the technique.

If the following relative yield percentages are given for the subclasses:

2C	80%
2E	75%
2W	70%
3C	60%
3W	50%

Then the relative yield for 3E would be 55%.

(2) In the absence of a relative yield in a class above, a class below could be used.

(3) If neither of the two above applied, but a missing relative yield was bracketed by two relative yields within the same soil limitations, a linear interpolation was used. Example: If relative yields for 3W and 4W are missing, but relative yields for 2W of 85% and 5W of 55% were present,

values of 75% and 65%, respectively, would be used for 3W and 4W.

Using these procedures increased the data base by about 10-20%.

A further complication was encountered in that, while an LRA may extend into many states, relative yield data were usually collected for only one, and at most, three states, thus necessitating some assumptions about variability. Table C1 contains a list of the LRA's by state, indicating those for which relative yield data were collected; where the data were not supplied, the state which was closest and/or most suitable to use as a substitute source of relative yield data were indicated. In this work we had the assistance of Dr. Ken Nicol, who had aided in the development of the relative yield data for the Soil Conservation Service.

To estimate yield data, three distinct sets were combined. Average yields for crops of interest were obtained from the Oklahoma State Farm Enterprise Data System, or for regions not yet covered by their research, from the data base used by Taylor and Swanson (1975). Acreages of each crop group (Corn-Sorghum, Other Row crops, i.e., Soybeans and Cotton, and Close Grown crops, i.e. Wheat, Barley, Oats, and Rye) were obtained for each county and all 13 soil subclasses in classes I-IV from the Conservation Needs Inventory. Finally, relative yield data were derived for each LRA and each crop type (Corn, Sorghum, Small grains, Soybeans, and Cotton), and for as many soil subclasses as possible, from the data received from the Soil Conservation Service.

The following notation will be helpful in describing the procedures used to create the desired yields.
Let

i index the producing regions, i = 1,...,135.

j index the Land Resource Areas, j = 1,...,153.

k index the counties in the Continental United States

K(i) denote the set of counties comprising producing region i

m index the crop groups

m' index the crops in the model

s index the 13 soil subclasses from I to IV

s' index the four soil classes

S(s') denote the soil subclasses in soil class s'.

These are given as follows:

s'	S(s')	
I	1	representing Soil Subclass I
II	2,3,4,5	representing Soil Subclasses II(E), II(W) II(S), & II(C)
III	6,7,8,9	representing Soil Subclasses III(E), III(W) III(S) & III(C)
IV	10,11,12,13	representing Soil Subclasses IV(E), IV(W) IV(S) & IV(C)

Then we may denote the 3 data sets as follows:

TA (k,s,m) = total acreage of crop group m in soil subclass s in county k, as given in the Conservation Needs Inventory.

Y(i,m') = average yield, from the crop budgets, of crop m' in producing region i.

P(k,s,m) = relative yield percentage, when available, for crop group m, soil subclass s, in county k, obtained from that LRA which corresponds to the main soil types in the county. These data were obtained from data supplied by the Soil Conservation Service. Define P(k,s,m) = 0 when the relative yields do not exist or cannot be approximated from the data given.

The desired table of yields may be denoted

Y(i,s',m') = estimated yield of crop m' within soil class s' in producing region i.

Since the relative yields are given as a proportion of the best yield possible, it is necessary to compute $\overline{Y}(i,m')$ = the yield of crop m' on the best soil subclass within producing region i.

To obtain this, let $\overline{P}(i,m')$, the aggregate relative yield data for crop m' in producing region i, be given by:

$$\overline{P}(i,m') = \frac{\sum_{s=1}^{13} \sum_{k \in k(i)} P(k,s,m)\ TA(k,s,m)}{T^*(i,m)}$$

where T*(i,m) is the total land in crop group m in producing region i, for which relative yield data, i.e. P(k,s,m), exist.

Then $\overline{Y}(i,m') = Y(i,m)/\overline{P}(i,m)$, where m is the crop group to which crop m' belongs. Table C2 makes this correspondence explicit.

Thus, it suffices to find the aggregate relative percentage yields $\overline{P}(i,s',m')$ for producing region i, soil class s', and crop m'. The formula used was:

$$\overline{P}(i,s',m') = \frac{\sum_{s \in S(s')} \sum_{k \in K(i)} P(k,s,m)\ TA(k,s,m)}{T^*(i,s',m)}$$

where T*(i,s,m) is the total land in crop group m (corresponding to m' -- see Table C2,) within soil class s' in producing region i; as above, the sum is only over those acreages TA(k,s,m,)for which P(k,s,m) exist.
Then

$$Y(i,s',m') = \bar{Y}(i,m')\ \bar{P}(i,s',m').$$

However, in several cases not enough land was available to compute $\bar{P}(i,s',m')$; that is, the ratio

$$\frac{T^*(i,s'm)}{\sum_{s\in S(s')} \sum_{k\in k(i)} TA(k,s,m)}$$

was 0 or quite low (less than .25). In these cases, it was decided that more accuracy could be obtained from choosing values of $\bar{P}(i,s',m')$ either from a similar crop within the producing region or the same crop from within a nearby producing region. A list of these choices, and alternative choices where several existed, is given in Table C3. Using these values of $\bar{P}(i,s',m')$ the estimates of disaggregated yields were completed.

As mentioned above, the yield and cost data were obtained from several sources. The preferred choice, when several sources were available, was the Farm Enterprise Data System (Garst, 1975). When these were not available data from the APAS budgets or data derived by Taylor and Swanson (1975) were used. In Appendix A above is a discussion of the methods used to update the 1970 cost data to 1973, the base year of the Farm Enterprise Data System. It was also necessary to update the yields, and this is discussed below.

As with cost data, the smallest unit for which data were available is the state. Therefore, for each state and crop we computed the 3 year average yield for 1969-71 and 1972-74, and then divided through to obtain update ratios. These ratios are given in Table C4, and were used for all yields obtained from either the APAS budgets or from Drs. Taylor and Swanson. The final yields are given above in table 1.

TABLE C1. Land Resource Areas (LRA's), indicating those for which relative yield data were collected; where no data were collected, the state which was closest and/or most suitable to use as a substitute source is indicated. (See figure C1)

STATE	LRA's PRESENT	DATA PRESENT	ALTERNATE STATE/LRA	OTHER STATES POSSIBLE
Alabama	125		Ky*	
	128		Ga.	Va.
	129	x		
	133	x		
	135	x		
	136		Ga.	N.C.
Arizona	30		Cal.*	
	35	x		
	36		N. Mex.*	
	39	x		
	40	x		
	41	x		
Arkansas	116		Mo.*	
	117	x		
	118	x		
	119	x		
	131	x		
	132	x		
	133		La.	N.C., Ala.
	134		Miss.*	
California	14	x		
	15	x		
	17	x		
	19	x		
	20	x		
	29		Nev.*	
	30	x		
	31	x		

* Only data from one other state available.

STATE	LRA's PRESENT	DATA PRESENT	ALTERNATE STATE/LRA	OTHER STATES POSSIBLE
Colorado	45	x		
	48	x		
	51	x		
	67	x		
	69	x		
	72		Kansas*	
Delaware	(see Pennsylvania)			
Florida	133		Ala.	La., N.C.
	138	x		
	152	x		
	153		S.C.	N.C.
	154	x		
	155	x		
	156	x		
Georgia	128	x		
	130		N.C.*	
	133		Ala.	La., N.C.
	136	x		
	137		S.C.*	
	153		S.C.	N.C.
Idaho	9		Wash.*	
	10		Ore.*	
	11	x		
	12	x		
	13	x		
	25	x		
	28		Utah*	
	43	x		
	44		Montana*	
	47		Utah*	
Illinois	95		Wis.*	
	105		Wis.*	
	108	x		
	110	x		

STATE	LRA's PRESENT	DATA PRESENT	ALTERNATE STATE/LRA	OTHER STATES POSSIBLE
Illinois	113	x		
(cont.)	114	x		
	115		Mo.*	
Indiana	98		Mich.*	
	110		Ill.*	
	111	x		
	114		Ohio	Ill.
	115		Mo.*	
	120		Kent.*	
	121		Kent.*	
	122		Tenn.*	
Iowa	102		S.D.*	
	103		Minn.*	
	104	x		
	105		Wis.*	
	107	x		
	108		Ill.*	
	109		Mo.*	
Kansas	72	x		
	73	x		
	74	x		
	75	x		
	76	x		
	77		Tex.*	
	78		Okla.*	
	79	x		
	80		Okla.*	
	106		Neb.*	
	107		Iowa*	
	112	x		
Kentucky	120	x		
	121	x		
	122		Tenn.*	

STATE	LRA's PRESENT	DATA PRESENT	ALTERNATE STATE/LRA	OTHER STATES POSSIBLE
Kentucky (cont.)	125	x	N.C.	Ala., La.
	133		Miss.*	
	134		Ark.*	
Louisiana	131			
	133	x	Miss.*	
	134		Tex.*	
	150			
	151	x		
Maryland (see Pennsylvania)				
Michigan	92	x	Wis.*	
	93			
	94	x		
	96	x		
	97	x		
	98	x		
	99	x	Ind.*	
	111		N.D.*	
Minnesota	56			
	57	x		
	88	x	Wis.*	
	90		S.D.*	
	102			
	103	x	Iowa*	
	104		Wis.*	
	105		Ark.*	
Mississippi	131		Ala.	La., N.C.
	133			
	134	x	Ala.*	
	135			

STATE	LRA's PRESENT	DATA PRESENT	ALTERNATE STATE/LRA	OTHER STATES POSSIBLE
Missouri	107		Iowa*	
	109	x		
	112		Kansas*	
	113		Ill.*	
	115	x		
	116	x		
	131		Ark.*	
Montana	43		Idaho*	
	46	x		
	52	x		
	53		N.D.*	
	58	x		
	59	x		
Nebraska	64	x		
	65	x		
	66		S.D.*	
	67		Col.*	
	71	x		
	72		Kansas*	
	73		Kansas*	
	75	x		
	102		S.D.*	
	106	x		
New Jersey	(see Pennsylvania)			
New Mexico	36	x		
	37	x		
	39		Ariz.*	
	42	x		
	48		Col.*	
	51		Col.*	
	70	x		
	77		Texas*	

STATE	LRA's PRESENT	DATA PRESENT	ALTERNATE STATE/LRA	OTHER STATES POSSIBLE
New York	101	x		
	140	x		
	141	x		
	142	x		
	143		Maine*	
	144		N.H.*	
	149		N.J.*	
North Carolina	130	x		
	133	x		
	136	x		
	137		S.C.*	
	153	x		
North Dakota	53	x		
	54	x		
	55	x		
	56	x		
	58		Mont.*	
Ohio	99		Mich.*	
	100	x		
	111		Ind.*	
	114	x		
	124	x		
	126		W. Va.*	
	139	x		
Oklahoma	76		Kansas*	
	77		Texas*	
	78	x		
	80	x		
	84	x		
	85		Texas*	
	112		Kansas*	
	116		Mo.*	

STATE	LRA's PRESENT	DATA PRESENT	ALTERNATE STATE/LRA	OTHER STATES POSSIBLE
Oklahoma	117		Ark.*	
(cont.)	118		Ark.*	
	119		Ark.*	
Oregon	2	x		
	8	x		
	9		Wash.*	
	10	x		
	23	x		
	43		Idaho*	
Pennsylvania	126		W. Va.*	
(including Delaware, N.J., and Maryland)	127	x (Pa.)		
	140		N.Y.*	
	147	x (Pa.)		
	148		Va.*	
	149	x (N.J.)		
	153		N.C.	S.C.
South Carolina	133		N.C.	La., Ala.
	136		Ga.	N.C.
	137	x		
	153	x		
South Dakota	53		N.D.*	
	54		N.D.*	
	55		N.D.*	
	58		Mont.*	
	60	x		
	61	x		
	62	x		
	63	x		
	64		Neb.*	
	66	x		
	102	x		

STATE	LRA'S PRESENT	DATA PRESENT	ALTERNATE STATE/LRA	OTHER STATES POSSIBLE
Tennessee	122	x		
	123	x		
	125		Kent.*	
	128		Ga.	Va.
	130		N.C.*	
	131		Ark.*	
	133		Ala.	N.C., La.
	134		Miss.*	
Texas	42		N. Mex.*	
	77	x		
	78		Okla.*	
	80		Okla.*	
	81	x		
	82	x		
	83	x		
	84		Okla.*	
	85	x		
	86	x		
	87	x		
	133		La.	N.C., Ala.
	150	x		
Virginia	125		Kent.*	
(includes West Va.)	126	x (W. Va.)		
	127		Pa.*	
	128	x (Va.)		
	130		N.C.*	
	133		N.C.	La., Ala.
	136		N.C.	Ga.
	147		Penn.*	
	148	x (Va.)		
	149		N.J.*	
	153		N.C.	S.C.

TABLE C2. Correspondence Between Crops and Crop Groups Used in the Model.

Crops in the Model	Crop Groups used by the Conservation Needs Invent.	Crop Groups used by the Soil Conservation Service
Corn	Corn - Sorghum	Corn
Sorghum	Corn - Sorghum	Sorghum
Wheat	Close Grown Crops	Small Grains
Oats	Close Grown Crops	Small Grains
Barley	Close Grown Crops	Small Grains
Rye	Close Grown Crops	Small Grains
Soybeans	Other Row Crops	Soybeans
Cotton	Other Row Crops	Cotton

TABLE C3 . A listing of those aggregated relative percentage yields [denoted P(i,s'm') in the text] which were taken from other crops or from other producing regions, with alternative choices possible.

Producing Region with missing Data.	Crop	Producing Region with Data.	Crop	Alternatives, if any	
North Carolina					
4	Sorghum	4	Corn		
5-6	Cotton	7	Cotton		
8	Cotton	7	Cotton		
8	Sorghum	8	Corn		
Alabama					
18	Corn	56 (Ms.)	Corn	19 (Ala.)	Corn
20-22	Corn	55 (Ms.)	Corn	19 (Ala.)	Corn
Georgia					
28	Corn	29	Corn	25 (Fla.)	Corn
South Carolina					
30	Cotton	7 (N.C.)	Cotton	31 (S.C.)	Cotton
Arkansas					
34-35	Sorghum	103 (Okla.)	Sorghum		
38-40	Sorghum	103 (Okla.)	Sorghum		
38-40	Corn	11 (Tenn.)	Corn		
Louisiana					
41-43	Sorghum	107 (Okla.)	Sorghum	44 (La.)	Sorghum
45	Sorghum	107 (Okla.)	Sorghum	44 (La.)	Sorghum

TABLE C3. (Continued)

Producing Region with missing Data	Crop	Producing Region with Data	Crop	Alternatives, if any	
Mississippi					
46-48	Corn	41 (La.)	Corn	49 (Ms.)	Corn
46-55	Sorghum	103 (Okla.)	Sorghum	107 (Okla.) or 44 (La.)	Sorghum
52-54	Corn	49 (Ms.)	Corn	55 (Ms.)	Corn
56	Sorghum	107 (Okla.)	Sorghum	44 (La.)	Sorghum
Michigan					
58	Soybeans	59 (Mich.)	Soybeans		
Illinois					
66-68	Soybeans	66-68	Corn		
69	Sorghum	78 (Mo.)	Sorghum	69 (Ill.)	Corn
Indiana					
70	Sorghum	70	Corn		
71	Sorghum	71	Corn	78 (Mo.)	Sorghum
Iowa					
72-75	Sorghum	72-75	Corn		
Missouri					
76-77	Sorghum	78	Sorghum		
79	Sorghum	78	Sorghum		
Kansas					
83-84	Irr. Corn	87-88 (Neb.)	Irr. Corn	112-113 (Colo.)	Irr. Corn
85	Soybeans	86	Soybeans	84	Soybeans

TABLE C3 (Continued)

Producing Region with missing Data	Crop	Producing Region with Data	Crop	Alternatives, if any	
Nebraska					
87-88	Irr. Soy.	89	Irr. Soy.		
North Dakota					
90-91	Corn	92	Corn		
92	Soybeans	89 (Neb.)	Soybeans		
South Dakota					
93	Soybeans	94	Sorghum		
Oklahoma					
97	Irr. Corn	104 (Tex.)	Irr. Corn		
102	Soybeans	103	Soybeans		
Texas					
105	Soybeans	107	Soybeans		
111	Soybeans	44 (La.)	Soybeans	107 (Tex.)	Soybeans
California					
117	Irr. Corn	117	Irr. Sorghum		
121	Corn	121	Sorghum		
Arizona					
122	Irr. Sorgh.	120 (Ca.)	Irr. Sorghum		
123	Irr. Sorgh.	124 (Ariz.)	Irr. Sorghum		

State	Yield Ratios by Crop							
	Corn	Sorghum	Wheat	Oats	Barley	Rye	Soybeans	Cotton Lint and Seed
Arizona		1.043	1.005		1.410			1.240
Arkansas	1.152	1.019	.953	1.017			1.012	.909
California	1.100	.999	1.287		1.040			1.166
Florida	1.203		.635				.873	1.087
Idaho			.934		.946			
Kentucky	1.241		.874				.909	
Louisiana	1.527	.982	.875	.968			1.094	.867
Mississippi	1.277	.749	.865	.913			.872	.944
Montana			.967	.921	.844			
New Mexico		.943	.946	.916				1.541
New York	.987		.927	.899	.824			
N.C. (one prod. region only)	1.351							
Oregon			.973		.968			
Penn., N.J., Delaware, Md.	1.003		.796	1.217	.912		.894	
Tenn. (one prod. region only)	1.378		.902		.795		.911	
Virginia, W. Virginia	.836		.858		.942		1.088	
Washington			.910		.903	.884		

Table C4. Yield Ratios (1972-74 average yield divided by 1969-71 average yield) for all states and crops whose budgets were obtained from APAS or from Taylor and Swanson.

APPENDIX D

NUTRIENT AND COMMODITY DEMANDS

Two main types of demand constraints are used in this model, Nutrient demand constraints and Commodity demand constraints. The nutrient constraints consist of separate constraints for Total Digestible Nutrients (TDN), Digestible Protein (DP) and Bulk (W) for Cattle, Sheep, and Hogs. Demand for individual commodities is composed of human demand for food, feed demand for poultry, horses and mules, and other livestock (mainly pets), and demand for seed and exports.

NUTRIENT DEMANDS

The nutrient demand data used by Taylor and Swanson (1975) are based on assumptions concerning feed composition and consumption levels of the various feeds, by cattle, sheep and hogs, and demands are calculated for 1970 animal numbers. This study accepts their basic assumptions and uses data on change in the numbers of cattle, sheep, and hogs between 1970 and 1973 to update their data. The update ratios used are shown in Table D1. The constraint values have already been given in table 6 above. In calculating the update ratios Milk Cows, Other Dairy Cattle on Feed, and Other Beef were included in cattle numbers. The published total figures were used for sheep and hogs.

COMMODITY DEMANDS EXCLUDING EXPORTS

A similar procedure was used in estimating individual commodity demands. Data from Taylor (1975) indicating crop utilization by Poultry, Horses, and Mules, Other Livestock and humans were updated using population change ratios. In calculating the poultry ratio Turkeys, Hens and Pullets, Chickens Raised, and Broilers were included in poultry numbers. No data were available for Horses and Mules or Other Livestock but it was assumed that these have increased in the same proportion as the human population. Since these animals are primarily used as pets or for recreational purposes, this assumption is reasonable. Data on human population numbers were obtained from Bureau of the Census (1975) publications. Data from Taylor (1975) indicating endogenous crop utilization for seed were updated using acreage change ratios for each crop. These ratios and the values for these demands are shown in Tables D2 to D6.

EXPORTS

Data on agricultural exports and imports by commodity (U.S. Bureau of the Census, 1974a, 1974b) were used to calculate 1973 total net exports of

each of the endogenous crops. Only raw crops and the products of simple grading and separating processes (e.g. milling, oil extraction, cotton ginning) are considered. For any particular crop total exports are obtained by summing exports of the raw crop and exports of each product derived directly from that crop. Thus total wheat exports is the sum of unmilled wheat exports, wheat flour and semolina exports, wheat meal and groats exports, and wheat byproducts. Similarly, total soybean exports is the sum of exports of raw soybeans, all grades of soybean oil and soybean oilmeal and oilcake. This aggregation procedure is based on the assumption that any foreign material incorporated during the grading or separation processes is exactly offset by the amount of raw crop material wasted.

The products of complex industrial processes are excluded (e.g. oleo, alcohol) as are prepared animal feeds. However, these account for less than 1% of total agricultural exports so the error involved is not serious.

Total exports of each crop are allocated to each consuming region in the same proportions as those used by Taylor and Swanson (1975). This assumes that the regional pattern of exports has not changed since 1970 (the base year for the Taylor and Swanson study). This assumption is necessary at the present time, in the absence of other data. However, it is expected that data showing exports and imports by customs districts and port will be obtained in the near future. This will allow exports by consuming region to be calculated directly.

Total exports and exports by consuming region for each crop are shown in Table D7.

EXOGENOUS PRODUCTION

Exogenous production refers to production which is known to take place but is excluded from the model. This can occur where the whole area is excluded from the model (e.g. New England, Utah-Nevada, and parts of other western states), or where a particular crop is grown in a particular producing region but no corresponding budget is included in the model. Exogeneous acreage is defined similarly.

To estimate exogenous production a variety of methods was employed. For the eight states in the continental U.S. (Maine, Vermont, New Hampshire, Connecticut, Rhode Island, Massachusetts, Utah and Nevada) totally exogenous to the model, data from the U.S.D.A. Agricultural Statistics (1975) were used to estimate exogenous production in 1973.

In those states (Washington, Oregon, Idaho, Montana, Colorado, Wyoming, New Mexico, Arizona, and California) which contained agricultural land outside the 135 producing regions, the acreage data from the Conservation Needs Inventory (see Section B) were used to obtain an estimate of the percentage of the acreage of each crop group lying exogenous in each state. (See table C2 for the correspondences of crops and crop groups). Then the percentages were multiplied by the 1973 production figures for each crop, obtained from Agricultural Statistics (U.S.D.A. 1975), to yield an estimate of exogenous production. The two assumptions made were that distribution of crop acreage

among the crops in each group did not change between the endogenous and exogenous areas of each state, and that yields in the exogenous regions were equal to state reported yields.

A similar procedure was used to estimate exogenous production within each producing region. For each missing budget in each producing region, the percentage of total state crop group acreage occupied by that producing region's crop group is computed, and then multiplied by state crop production to obtain an estimate of exogenous production within the producing regions. The same two assumptions as above apply.

The estimates from each crop are then aggregated and are given in table D8. In some places the assumption of homogeneous distribution within crop groups was clearly wrong, and so estimates were obtained from other sources, and these are indicated by asterisks in table D8. Finally, the commodity demands given in tables D3-D6 are adjusted for exogenous production and exports, and the final demands given in table 6 above.

Similar methods to those described above were used to obtain the estimates of exogenous acreage reported in table 17 of the main report.

TABLE D1

UPDATE RATIOS USED IN DERIVING VALUES FOR

THE NUTRIENT CONSTRAINTS IN THE MODEL

CONSUMING REGION	CATTLE	SHEEP	HOGS
1	.94	.70	.98
2	1.07	.76	.89
3	1.04	.78	.99
4	1.07	.89	.89
5	1.03	.87	.90
6	.98	.89	.77
7	.96	.92	.90
8	1.03	.89	.92
9	1.09	.61	.78
10	1.08	.69	.88
11	1.22	.79	.81
12	1.03	.69	.72
13	1.22	.87	.71
14	1.11	.92	.93
15	1.07	1.02	1.05
16	1.06	.85	.89
17	1.12	.94	.86
18	1.13	.93	1.14
19	1.03	.84	.72
20	1.01	.88	.81
21	.97	.86	.87

TABLE D2.

UPDATE RATIOS USED IN CALCULATING INDIVIDUAL COMMODITY DEMANDS FOR HUMAN AND LIVESTOCK FOOD AND SEED

CONSUMING REGION	POULTRY	HUMAN POP.	CORN	SORGH.	WHEAT	OATS	BARLEY	RYE	SOYBEANS	COTTON	PEAS
			ACREAGE RATIOS								
1	0.85	1.01	.95	2.57	1.34	0.59	1.29	.80	1.31	0	-
2	1.19	1.02	1.07	1.57	.93	.63	.57	.99	1.36	.78	-
3	1.07	1.03	1.16	-	2.33	0.79	1.44	.73	1.42	-	.89
4	.99	1.02	1.17	-	1.00	.71	.96	.82	1.30	-	-
5	.89	1.01	1.03	2.00	.83	1.01	.88	.52	1.38	-	-
6	.93	1.03	1.18	-	-	.68	-	-	-	-	-
7	1.03	1.01	1.13	-	.66	.90	.93	.95	1.57	-	-
8	.97	1.04	1.02	1.36	1.46	.79	.95	.80	1.43	1.06	-
9	1.05	1.04	1.00	1.92	.94	.91	1.23	.53	1.51	1.07	-
10	.98	1.04	1.06	1.10	1.34	.94	1.33	1.34	1.48	.94	-
11	1.12	1.14	.93	-	1.22	1.10	-	-	1.39	.95	-
12	1.05	1.04	.57	.63	.76	.59	-	-	1.08	1.04	-
13	.92	1.05	1.18	1.17	1.26	.89	.55	.96	1.78	1.03	-
14	.81	1.02	1.18	1.11	1.10	.69	.46	.67	1.30	-	-
15	.82	1.08	1.10	.91	1.33	.82	1.03	.73	1.42	-	-
16	1.02	1.02	1.27	-	1.21	.77	1.19	-	-	-	.40
17	1.17	1.11	1.21	.95	.90	.60	.99	.45	-	-	-
18	.83	1.14	1.08	.92	1.35	-	.94	-	-	1.07	-
19	1.08	1.10	1.41	-	1.29	.79	1.09	-	-	.83	-
20	.88	1.03	1.23	-	1.41	.62	.74	.45	-	-	.49
21	.97	1.03	1.24	.74	1.10	.84	.81	-	-	1.43	-

TABLE D3. Estimated Demand (million lbs) for Corn and Sorghum by Poultry, Horses and Mules, Other Livestock, Human Food, and Seed Requirements, 1973

CONSUMING REGION	CORN						SORGHUM					
	Poultry	Horses & Mules	Other Live-Stock	Food	Seed	TOTAL[1]	Poultry	Horses & Mules	Other Live-Stock	Food	Seed	TOTAL[1]
1	399	37	696	1,172	12	2,317	101	2	56	26	(Z)	184
2	1,949	116	1,918	799	190	4,973	465	6	154	18	4	647
3	1,719	68	1,055	884	118	3,843	409	3	85	20	-	517
4	370	20	176	129	24	719	94	1	15	21	-	131
5	1,456	76	771	1,671	105	4,080	362	4	62	37	1	465
6	1,228	10	83	1,301	4	2,627	250	1	15	28	-	294
7	10,050	63	453	4,393	44	15,005	1,715	3	52	97	-	1,867
8	2,928	150	508	1,328	28	4,941	530	7	44	29	1	583
9	716	154	364	776	22	2,032	143	8	30	17	1	199
10	5,792	203	132	1,154	34	7,316	929	10	68	25	2	1,035
11	936	21	179	808	3	1,948	204	1	14	18	-	237
12	4,788	292	317	845	4	6,246	789	15	50	19	2	874
13	1,529	199	731	1,509	2	3,969	288	10	61	33	67	458
14	404	57	946	397	103	1,907	101	3	78	9	36	227
15	276	74	355	145	39	889	71	4	29	3	3	111
16	132	84	68	150	3	437	28	4	11	3	-	47
17	201	62	283	294	12	851	50	3	25	6	4	89
18	86	129	72	332	1	619	21	6	14	7	5	54
19	210	44	15	178	2	448	52	2	6	4	-	64
20	476	22	62	591	2	1,153	105	1	11	13	-	130
21	2,979	10	579	2,146	7	5,721	682	1	47	47	1	777

[1] Totals may not add due to rounding.

(Z) Less than 0.5 million lbs.

TABLE D4 . Estimated Demand (million lbs) for Wheat and Oats by Poultry, Horses and Mules, Other Livestock, Human Food and Seed Requirements 1973

CONSUMING REGION	WHEAT					OATS					
	POULTRY	OTHER LIVE-STOCK	FOOD	SEED	TOTAL[1]	POULTRY	HORSES & MULES	OTHER LIVE-STOCK	FOOD	SEED	TOTAL[1]
1	21	18	1,727	182	1,948	120	22	11	87	57	298
2	120	49	1,177	124	1,470	415	70	31	59	198	773
3	118	27	1,303	190	1,638	303	40	17	66	380	765
4	23	5	1,393	86	1,506	107	12	3	70	27	218
5	99	20	2,463	209	2,790	368	46	12	124	87	637
6	54	5	1,877	-	1,936	274	6	3	94	4	381
7	538	17	6,475	227	7,257	1,010	38	10	326	70	1,453
8	164	14	1,975	59	2,195	385	89	9	93	85	668
9	35	10	1,143	48	1,235	155	92	6	57	130	440
10	250	22	1,699	45	2,016	783	122	14	85	134	1,138
11	48	5	1,191	7	1,250	233	13	3	60	28	335
12	226	16	1,245	81	1,568	619	175	10	63	16	883
13	83	20	2,222	681	3,007	212	119	12	112	158	613
14	22	25	585	860	1,493	116	34	16	29	49	244
15	18	9	213	918	1,159	69	44	6	11	322	452
16	6	4	221	366	596	32	56	3	12	26	128
17	15	8	434	123	579	35	37	5	22	12	111
18	4	4	489	29	526	27	77	3	25	-	131
19	18	2	262	25	307	21	26	1	13	3	64
20	26	3	872	309	1,210	104	13	2	44	15	179
21	164	15	3,162	36	3,378	663	6	10	159	31	868

[1] Totals may not add due to rounding.

TABLE D5. Estimated Demand (million lbs) for Barley and Rye by Poultry, Horses and Mules, Other Livestock, Human Food and Seed Requirements 1973.

CONSUMING REGION	BARLEY						RYE				
	POULTRY	HORSES & MULES	OTHER LIVE-STOCK	FOOD	SEED	TOTAL[1]	POULTRY	OTHER LIVE-STOCK	FOOD	SEED	TOTAL[1]
1	22	1	75	318	2	418	1	1	30	8	39
2	85	3	207	22	17	333	6	3	20	3	32
3	67	2	115	240	136	560	6	1	22	10	40
4	20	(Z)	20	256	2	299	1	(Z)	24	16	41
5	71	2	83	453	3	612	5	1	42	11	59
6	49	(Z)	20	346	-	415	3	(Z)	32	-	36
7	213	2	70	1,192	39	1,515	32	1	111	44	188
8	79	4	3	360	19	465	8	1	34	30	72
9	28	4	35	210	8	285	2	1	20	30	52
10	144	5	91	313	13	566	13	1	29	60	104
11	42	1	19	219	-	281	2	(Z)	20	-	23
12	117	7	67	229	(Z)	421	12	1	21	-	34
13	44	5	82	409	23	562	4	1	38	87	131
14	21	1	105	108	9	245	1	1	10	79	91
15	14	2	39	39	219	313	1	1	4	27	33
16	6	2	15	41	137	201	(Z)	(Z)	4	1	5
17	8	1	33	80	36	159	1	(Z)	7	3	12
18	5	3	19	90	16	133	(Z)	(Z)	8	-	9
19	7	1	8	48	16	80	1	(Z)	5	-	6
20	20	1	15	160	46	242	1	(Z)	15	5	22
21	130	(Z)	63	582		877	9	1	54	-	64

[1]Totals may not add due to rounding.

(Z) Less than 0.5 million lbs.

TABLE D6. Estimated Demand (million lbs) for Soybeans and Cottonseed By Poultry, Other Livestock and Seed Requirements 1973.

CONSUMING REGION	SOYBEANS				COTTONSEED		
	POULTRY	OTHER LIVE-STOCK	SEED	TOTAL[1]	POULTRY	SEED	TOTAL[1]
1	136	223	592	951	21	(Z)	21
2	749	612	851	2,212	156	1	156
3	660	339	1,198	2,197	149	-	149
4	141	59	49	249	23	-	23
5	524	246	560	1,330	94	-	94
6	469	58	-	527	59	-	59
7	1,536	206	49	792	182	-	182
8	1,441	175	131	1,747	206	5	211
9	304	118	419	842	38	1	39
10	2,614	271	216	3,100	296	34	330
11	378	56	16	450	49	(Z)	50
12	2,450	198	557	3,206	285	81	367
13	748	243	57	1,048	115	146	261
14	144	312	154	609	23	-	23
15	108	116	45	270	21	-	21
16	55	45	-	100	7	-	7
17	83	98	-	181	22	-	22
18	30	55	-	85	4	11	16
19	88	23	-	110	27	(Z)	27
20	191	43	-	235	30	-	30
21	1,066	188	-	1,254	184	9	193

[1] Totals may not add due to rounding.

(Z) Less than 0.5 million lbs.

TABLE D7. Net Exports of Agricultural Products (million lbs)
By Consuming Region - Estimated 1973 Levels.

CONSUMING REGION	CORN	SORGH.	WHEAT	OATS	BARLEY	RYE	SOYBEANS	COTTON-SEED
1	7,433	-	249	-	-	-	3,765	-
2	-	-	-	-	-	-	-	-
3	4,658	-	6,583	1,543	2,516	1,716	1,136	-
4	159	-	56	-	-	-	167	-
5	3,917	-	381	-	-	-	4,243	-
6	30	-	-	-	-	-	(Z)	-
7	3,387	-	620	-	-	14	510	-
8	5,951	-	1,434	-	-	-	1,221	-
9	-	-	-	-	-	-	-	-
10	922	14	307	-	-	123	2,418	55
11	-	-	-	-	-	-	-	-
12	27,546	450	9,224	50	68	14	23,495	248
13	983	11,114	38,576	-	77	-	2,635	339
14	-	-	-	-	-	-	-	-
15	174	-	-	-	-	-	141	-
16	15	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-
18	4	-	-	-	-	-	11	-
19	-	-	-	-	-	-	-	-
20	144	-	26,855	4,311	1,297	26	6	-
21	287	793	8	-	4	-	55	-
TOTAL	75,614	12,372	84,289	1,597	3,970	1,893	39,804	642

Z = less than 0.5 m. lbs.

Table D8. Estimated Exogenous Crop Production 1973 (million lbs).

Consuming Region	Corn	Sorghum	Wheat	Oats	Barley	Rye	Soybeans	Cotton-Seed
1	-	-	-	-	24	28	-	-
2	-	-	14	-	21	21	-	-
3	-	-	4	4	39	12	-	-
4	6				43		50	-
5	-	-	-	-	45	30	14	-
6	-	-	-	50	-	-	-	-
7	-	-	-	-	-	93	15	-
8	-	185	36	106	20	44	43	22
9	-	159	13	45	98	5	92	52
10	34	158	53	9	14	133	50	-
11	43	-	-	13	-	-	-	-
12	2	310	85	40	-	-	63	-
13	2,267	743	469	794	89	119	398	247
14	-	-	621	3	33	1	139	-
15	33	2	3	3	-	-	39	-
16	185	-	1,107	120	700	-	-	-
17	121	19	437	24	131	28	-	-
18	114	153	201	-	403	-	-	4
19	80	-	428	27	1,405	-	-	-
20	360	-	1,495	235	287	175	-	-
21	570	220	521	148	647	-	-	45

APPENDIX E

RAIL TRANSPORT COST COEFFICIENTS

The basic data used in this section were taken from Eyvindson (1970). However, Eyvindson's data were based on transport charges for 1963. It was therefore necessary to update the figure to reflect changes in transport charges between 1963 and 1973. Data on these changes were obtained from the ICC/DOT Statement TD-1 (Interstate Commerce Commission, 1965; Department of Transportation, 1975).

The data used showed average revenue for ton-mile for transporting individual crops between railroad rate territories in the U.S. as well as average revenue per ton-mile for total inshipments and total outshipments of each crop to/from each territory. These data were based on a 1% sample of all waybills in the years in question.

Ratios were calculated for each crop and each inter-territorial movement, for total inshipments of each crop to each territory, for total outshipments of each crop from each territory, and for total movements of each crop within the U.S. In several cases sufficient data were not available to calculate a ratio for a particular crop and inter-territorial movement. These ratios were obtained as follows:

(1) Where individual data were missing, data for total outshipments for the crop and territory involved were used.
(2) Where data for outshipments were also missing, data for total inshipments for the crop and territory involved were used.
(3) Where data on both outshipments and inshipments were missing, data for total movement of the crop in the United States were used.
(4) No data on movements of cottonseed were reported for 1973. For this reason, data on "Oil Seeds, Kernels, and Nuts" were used in place of cottonseed data for both years.

The ratios used to update Eyvindson's cost data are shown in Table E1. The cost coefficients used have been given in Pimentel et al. (1975).

Figure E1 shows the consuming regions used in this study, the cities in each at which transportation of commodities is assumed to originate and terminate, and the railroad rate territories used in calculating the update ratios. In the majority of cases, each city involved could be assigned to a unique railroad rate territory. Each inter-regional transport activity could then be associated with a particular inter-territorial movement. However, the city used for region 8 falls on the border of the Official and Southern rate territories, and the city used for region 17 falls on the

border of the Western Trunk Line and Mountain Pacific territories. The following procedure was therefore followed:

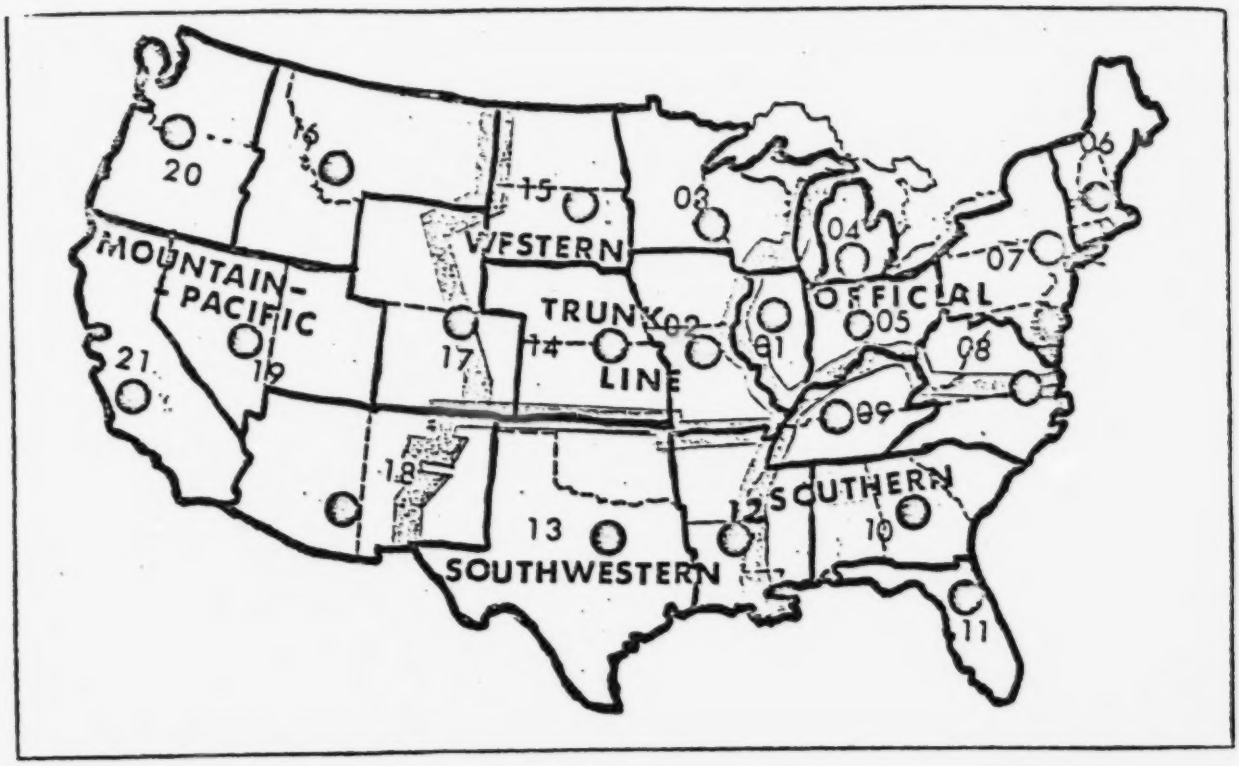
(a) Region 8 was assigned to the Official territory for movements to other regions in the Official and Western Trunk Line territories.

(b) Region 8 was assigned to the Southern territory for movements to regions in the Southern, South Western, and Mountain Pacific territories.

(c) Region 17 was assigned to the Western Trunk line territory for movements to all regions in the Western Trunk Line, Official Southwestern and Southern Territories.

(d) Region 17 was assigned to the Mountain Pacific territory for movements to all regions in the Mountain Pacific territory.

Figure E1. Consuming Regions and Railroad Rate Territories.



Source: Taylor and Swanson (1975); U.S. Department of Transportation (1975)

TABLE E1 . Ratios used to Update the Transport Cost Coefficients By Crop and Inter-Territorial Movement.

FROM \ TO	OFFICIAL	SOUTHERN	WESTERN TRUNK LINE	SOUTH-WESTERN	MOUNTAIN PACIFIC	U.S.*
			SOYBEANS			
OFFICIAL	0.411	1.018	0.432	0.432	0.432	0.432
SOUTHERN	0.880	0.880	0.880	0.880	0.880	0.880
W. TR. LINE	0.461	0.461	1.124	0.461	0.461	0.461
SOUTH WESTERN	1.603	1.665	1.603	1.409	1.603	1.603
MT. PACIFIC	0.416	1.092	1.124	0.844	0.585	-
U.S.*	0.416	1.092	1.124	0.844	-	0.585
			COTTONSEED			
OFFICIAL	0.536	0.402	0.536	0.452	0.536	-
SOUTHERN	0.566	0.516	0.566	0.566	0.566	0.566
W. TR. LINE	0.536	0.402	0.536	0.452	0.536	0.566
SOUTHWESTERN	0.677	0.677	0.677	0.772	0.677	0.677
MT. PACIFIC	0.536	0.402	0.536	0.452	0.536	-
U.S.*	-	0.402	-	0.452	-	0.536
			BARLEY AND RYE			
OFFICIAL	1.166	1.166	1.166	1.166	1.166	1.166
SOUTHERN	1.216	1.242	1.344	1.843	1.224	-
W. TR. LINE	1.244	1.244	1.336	1.860	1.244	1.244
SOUTHWESTERN	1.216	1.242	1.344	1.843	1.224	-
MT. PACIFIC	1.238	1.238	1.543	1.238	1.149	1.238
U.S.*	1.216	-	1.344	1.843	1.224	1.242
			OATS			
OFFICIAL	0.934	0.868	0.868	0.868	0.868	0.868
SOUTHERN	1.345	1.345	1.345	1.345	1.345	1.345
W. TR. LINE	1.026	1.026	1.255	1.189	1.026	1.026
SOUTHWESTERN	1.210	1.210	1.210	1.170	1.210	1.210
MT. PACIFIC	1.049	1.049	1.049	1.049	0.947	1.049
U.S.*	1.182	1.061	1.255	1.157	1.111	1.055

TABLE E1.(Continued)

FROM \ TO	OFFICIAL	SOUTHERN	WESTERN TRUNK LINE	SOUTH-WESTERN	MOUNTAIN PACIFIC	U.S.*
			SORGHUM			
OFFICIAL	1.118	1.277	1.200	1.046	1.028	-
SOUTHERN	1.118	1.277	1.200	1.046	1.028	-
W. TR. LINE	1.086	1.086	1.200	1.285	1.117	1.086
SOUTH WESTERN	1.095	1.095	1.095	1.049	1.145	1.-45
MT. PACIFIC	1.145	1.145	1.145	1.145	1.145	1.145
U.S.*	-	1.277	1.200	1.046	1.028	1.118
			CORN			
OFFICIAL	0.654	1.085	0.688	0.688	0.688	0.688
SOUTHERN	1.292	1.292	1.292	1.292	1.292	1.292
W. TR. LINE	1.201	1.102	0.939	1.007	1.383	0.864
SOUTH WESTERN	1.477	1.463	1.477	1.489	1.477	1.477
MT. PACIFIC	1.516	1.516	1.516	1.516	1.864	1.516
U.S.*	0.674	1.092	0.940	1.121	1.404	0.832
			WHEAT			
OFFICIAL	1.972	1.226	1.432	1.432	1.432	1.432
SOUTHERN	0.875	0.833	0.875	0.875	0.875	0.875
W. TR. LINE	0.619	1.313	0.952	1.323	0.787	0.750
SOUTHWESTERN	1.079	1.163	1.079	1.000	1.079	1.079
MT. PACIFIC	0.959	0.959	0.976	0.959	0.974	0.959
U.S.*	0.734	1.220	0.976	1.044	0.895	0.855

*"U.S." signifies total movements - Territory to U.S. gives data for total outshipments, U.S. to Territory gives data for total inshipments and U.S. to U.S. gives data for all movements of the particular commodity involved.

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